

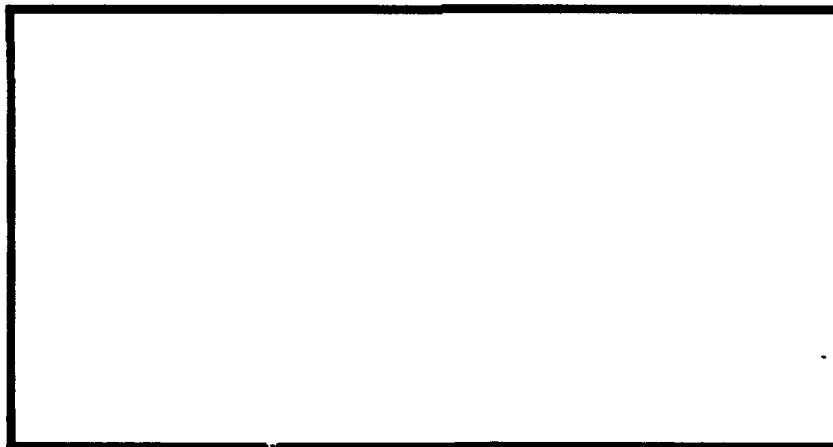
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A COMPARATIVE ANALYSIS OF  
COMPUTER END-USER SUPPORT  
IN THE AIR FORCE  
AND CIVILIAN ORGANIZATIONS

THESIS

Maureen C. Casey, Major, USAF  
Douglas A. Kveene, Captain, USAF

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A COMPARATIVE ANALYSIS OF COMPUTER END-USER SUPPORT  
IN THE AIR FORCE AND CIVILIAN ORGANIZATIONS

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology  
Air University  
In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Information Resource Management

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December 1991

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## Preface

The purpose of this study was to compare end user support in civilian organizations, in particular the information center, to end user support in the Air Force. Further, based on the results of the comparative analysis, the study was intended to provide recommendations which would optimize the benefits of end-user computing.

A study of this nature is important to the Air Force which has recently and formally recognized information as a corporate asset on the same par as manpower, money, and materials. It is therefore imperative that information and information processing be as effectively managed as other Air Force resources.

In conducting this exploratory research, we are deeply indebted to our thesis committee. Major Wayne Stone, thesis advisor, provided much needed insight, guidance, and perspective to the investigations. Dr. Richard Fenno, thesis reader, asked us the right questions at the right time so that we identified all assumptions as such. Lieutenant Colonel D. J. McBride, thesis committee member, provided the technical expertise in information resource management that we lacked. And finally, we would like to thank our families for their understanding and support. Major Casey would like to thank her husband, Bruce Bowdler, for graciously putting up with a diet of TV dinners and for his patience during even the most stressful times. Captain Kveene gives special thanks to his wife, Julie, and children Jeanne, Kristina, and Andrew who unselfishly gave up their free time with him throughout the past months so this endeavor could be concluded.

Maureen C. Casey  
Douglas A. Kveene

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Abstract

This study compared end-user computing support provided by the Air Force to support provided by civilian organizations with information centers and those without. Factors measured included the end user's demographics, applications used, the effect of computing on perceived confidence, productivity, quality and quantity of output, the importance of various types of support, and satisfaction with the support received from different sources. A survey was administered to 450 Air Force and 265 civilian end users; 416 were returned (response rate of 58.18%). Although there were significant demographic differences between end users, there were no differences in types of support required. Training, Maintenance, and Recovery support were rated as most important to end users. Combinations of applications used rather than single applications served to discriminate between end users. Information centers and computer user support offices provided the best support to end users when satisfaction ratings were weighted by the importance ratings. Indications point out that civilian organizations may be doing a better job of managing information as a resource at the end-user computing level than the Air Force. The study concluded that information centers are an appropriate means of providing support to Air Force end users.

A COMPARATIVE ANALYSIS OF COMPUTER END-USER SUPPORT  
IN THE AIR FORCE AND CIVILIAN ORGANIZATIONS

I. Introduction

Introduction

This chapter outlines the general issues which led to the initial exploration of this topic. The research objective is developed and the specific investigative questions are outlined. The scope, initial assumptions, and limitations to the research are discussed. The chapter ends with an overview of the study's organization.

General Issue

In 1974, IBM recognized the need to "address the industry-wide problem of the information systems development backlog" (Carr, 1987:326) and developed the Information Center. The support included training, technical support, tools, data availability, and system access (Carr, 1987:327). Many civilian organizations recognized the value of the information center and adopted the concept. Crwth (pronounced like tooth), a research firm in Santa Monica, California, reported 2,100 information centers in operation by 1984 (Carr, 1987:326).

During the 1980s, mini- and micro-computers appeared on the desks of white collar workers and "by 1986, there were 28 million work stations in the USA resulting in one work station for every two white collar workers." (Ghani and Al-Meer, 1989:191) This phenomenon was

due, in part, to IBM's introduction of the personal computer to the work place and the home. The people who owned these computers learned to use spreadsheet, database, and word processing applications, as well as to develop their own programs. They became known as end users. The numbers of end users grew dramatically as a result of the benefits derived from computer use and the technological advances which provided lower-priced and higher-powered micro-computers.

Although many organizations established information centers to support their end users, other organizations did not adopt the information center concept. The Air Force falls into this last group. Even though there are no formal information centers, there are many instances of an informal support structure. These support people or units emerged to meet the needs of Air Force end users.

Without the formal structure of an information center, is the Air Force receiving optimum benefit from micro-computer use without providing end-user support through information centers?

### Research Objective

The purpose of the study is to determine whether or not an information center is an appropriate means of providing support to end users in the Air Force.

### Research Hypotheses

Hypotheses that must be tested to meet the research objective are as follows:

Hypothesis 1: End users in the Air Force are similar to end users in civilian organizations with information centers and to end users in civilian organizations that do not have information centers.

Hypothesis 1a: The distribution of men and women in all three samples is not significantly different.

Hypothesis 1b: The age distribution in all three samples is not significantly different.

Hypothesis 1c: The distribution of end users' educational levels is the same for all three samples.

Hypothesis 1d: The number of end users in the three samples is not significantly different with regard to their job and placement level within the organization.

Hypothesis 1e: The length of time end users in each of the three samples have used a computer is similar.

Hypothesis 1f: The distribution of the amount of formal computer education is not significantly different between the three samples.

Hypothesis 1g: There is no significant difference between end users in each of the samples in the confidence they have in their ability to use various computer applications.

Hypothesis 1h: The types of applications used do not vary significantly among the samples.

Hypothesis 1i: There is no significant difference among the samples regarding who uses the results of end user's computing.

Hypothesis 1j: End users in each of the three samples agree on the effect that using a computer has had with regard to the quality and quantity of their work.

Hypothesis 1k: There is no significant difference in the levels of confidence end users in each of the three samples have in using a computer to meet the needs of their job.

Hypothesis 11: End users in each of the samples agree on the amount of increased productivity they would realize with stronger computer skills.

Hypothesis 2: End users in each of the three samples have similar support needs.

Hypothesis 3: There is no significant difference in the importance end users in each sample place on each type of support.

Hypothesis 4: There is no significant difference between end users in each sample in their choice of the source of support.

Hypothesis 5: End users in each sample are equally satisfied with the support they receive from each source of support for each type of support.

Hypothesis 6: An information center is the best source of support for meeting the needs of end users.

#### Justification

In light of recent budget reductions, the current state of the economy, and the general political climate, it would appear that the Air Force can look forward to a prolonged period of tight fiscal constraint. Even if these observations and assumptions are not valid, it is certainly prudent for any organization to attempt to optimize its resources. Since the introduction of the personal computer, the Air Force has purchased a considerable number of micro-computers.

The purpose of this study, to determine whether or not information centers would be an appropriate means of providing support to Air Force end users, is of great significance. A majority of Air Force personnel currently use a computer. Although they receive support from different

sources, they may not receive the most optimal support. The results of this study may provide justification to expand or enhance current sources of support, or to implement the information center concept. The Air Force should reasonably expect its members to produce a higher quality product after a decade-long investment in computer hardware and software.

### Scope

In the Air Force, investigations were limited to bases in the United States with virtually all assigned personnel belonging to one major air command. In civilian organizations, the investigations were limited to organizations with a single product line rather than widely diversified corporations. This limitation on the scope of the research provided additional control by minimizing the effects of additional independent variables which might be a result of organizational complexity.

### Limitations

Scope. The scope of the research itself is a limiting factor. Civilian populations were targeted at the industrial sector of Dayton. Entire sectors of the public, such as the service or medical sectors, were not addressed. The Air Force population was targeted at single wings without a higher headquarters. Consequently, end users are limited in rank and organizational position. The highest levels of management may be missing from the survey results in the Air Force population.

Potential Bias. Every reasonable effort was made to control bias, however, the following potential biases are noted:

(1) Civilian survey participants were selected by members of the Management Information Systems (MIS) department. Although a random sampling was requested, the MIS department may have selected those end users with a positive attitude toward MIS and have ignored those end users known to be dissatisfied.

(2) All of the civilian organizations participating in the study are located in the Dayton, Ohio, area. Although nothing has been found to indicate that end users in a particular geographic area are substantially different from end users in other geographic areas, some geographic bias may exist.

(3) Air Force survey participants were selected from three bases, representing three major air commands, Military Airlift Command (MAC), Strategic Air Command (SAC), and Tactical Air Command (TAC). This does introduce some bias. For example, few, if any, aeronautical and laboratory engineers are assigned to wing-level bases of MAC, SAC, or TAC. Therefore, engineering end users may be underrepresented in this study.

(4) There may also be some bias introduced in the Air Force end-user population as a result of the deployment of personnel to the Middle East during the period of the study. End users who might otherwise have been selected to participate in the survey were unavailable.

#### Assumptions

It is assumed that Air Force end users do not have different support needs than their civilian counterparts based solely on their military status. It is also assumed that Air Force end users do not use

a different set of criteria than civilian end users for determining their level of satisfaction with the support they received.

This study further assumes that individual respondents answered the survey questions truthfully, and not, for example, how they think they were "supposed" to reply.

### Thesis Organization

Following this introduction, the study includes a review of the literature pertinent to this research. Chapter 3 details the survey instrument, its construction, proposed data analysis techniques, and methodology employed in gathering the data. Chapter 4 analyzes the results of the survey. Chapter 5 interprets and draws conclusions from the analysis of the survey results and makes recommendations.



## II. Literature Review

### Introduction

This chapter examines relevant literature concerning end-user computing and information centers. Both are defined and a historical background describes their evolution and growth. End users are grouped by type and their support requirements are discussed. Some of the problems posed by end-user computing in the organization are addressed. Organizational responses to end-user demands and approaches to managing end-user computing are described, followed by a discussion of information centers.

### End-User Computing

Definition. End-user computing is a relatively new phenomenon whose growth began in the 1970s. At its simplest, end-user computing can be defined as "... the use and/or development of information systems by the principle users of the system's outputs or by their staffs" (Leitheiser and Wetherbe, 1986a:338). Doll and Torkzadeh (Doll and Torkzadeh, 1989:1152) defined end-user computing as follows:

End-user computing refers to direct interaction with applications software by managerial, professional, and operating level personnel in user departments. Some of these end-users may develop their own applications data base or decision support software. However, they are not professional software developers. For the most part, they are non-data processing trained users who use code written by others in the course of their work. (p. 1152)

For the purposes of this research, the following definition proposed by Sipior and Sanders (Sipior and Sanders, 1989) will be used.

End-user computing includes the development and use activities associated with the employment of computer resources, by one or more non-data processing professionals in functional areas, to perform or facilitate job-related tasks and responsibilities. Individuals are involved in end-user computing activities if, in employing computer resources, they either directly interact with the computer or are engaged in a task leading to direct interaction with the computer, such as coding. (p. 116)

Historical Background. As quoted by Colligan and Allman (Colligan and Allman, 1986:86), John F. Rockart, Director of the Center for Information Systems Research of the Sloan School of Management at MIT, says the growth of end-user computing can be grouped into three distinct eras associated with business computing. The first era spans from 1950 to 1960 and represents the first major attempts to use computers for business data processing. This era is characterized by the centralization of functional activities, development of large operational systems to handle corporate accounting tasks, and the use of line-type management techniques in information systems.

The second era of computing, 1960 to 1970, focused on putting computers to more creative uses. It was characterized by development of large systems for specialized applications, decentralization of functional activities, and the use of matrix management techniques (Colligan and Allman, 1986:86).

A complete change of focus occurred during the third era from 1970 to 1980. As the technology of computers changed, much of the computing power was being distributed to the end user instead of being supplied by the Electronic Data Processing (EDP) Department. This era was characterized by an increase in the importance of computer information, a substantial increase in the number of end users, more ad hoc

development of systems by end users, and new tools to make applications development easier (Colligan and Allman, 1986:87).

End-User Computing Growth. There are several reasons leading to the growth of end-user computing in the early 1970s. According to Couger (Couger, 1986:87), users had to learn complex commands in order to effectively use "dumb" terminals, even for their simplest functions. Additionally, the inability of data processing departments to accommodate the systems development needs of the organization led, in part, to the proliferation of micro-computer use. As micro-computer use grew, users placed even more demands on the data processing or management information systems departments (Cmar, 1988:348). End-user computing grew from zero percent of computer processing capacity in 1970 to 40 percent of computer processing capacity in 1980 (Leitheiser and Wetherbe, 1986a:337). Effectively managing end-user computing was a major challenge.

End-user computing continued to grow at a rapid pace in the 1980s. According to Rockart and Flannery, as reported by Sipior and Sanders (Sipior and Sanders, 1989:118), end-user computing grew at 50-90 percent per year as measured by the allocation of computer hardware and time-sharing expenditures, compared with a 5-15 percent growth rate in traditional data processing functions. This was due to users purchasing low-cost personal computers which were easy to learn, allowing them to tailor their own applications (Couger, 1986:87). Users found they could use their applications to circumvent information systems backlogs, often averaging three years, while acting as autonomous problem solvers (Couger, 1986:87). Increased awareness of end-user computing capabilities, business journal publications, and computer-related sales

calls, as well as an influx of college graduates with knowledge of computing tools also contributed to the increase in end-user computing (Sipior and Sanders, 1989:118). Colligan and Allman (Colligan and Allman, 1986:87-88) report the single most important reason for an increase in end-user computing as the ability to bypass EDP when solving simple business problems. Other reasons include reducing expensive outside time-sharing services, developing low-priority applications that can save time and money at the department level, and the ability to quickly manipulate data, format reports, and refine data analysis in a manner that will best suit the end user.

There were 28 million workstations (terminals and desk top computers) in the United States in 1986 -- one workstation for every two white collar workers (Ghani and Al-Meer, 1989:191). Today, end-user computing is even more feasible with the advent of fourth generation languages (4GL) and decreased hardware costs (Sipior and Sanders, 1989:118).

Types of End-Users. Several authors have proposed different groups or types of end users. Doll and Torkzadeh (Doll and Torkzadeh, 1988:261) group them into three very general categories: indirect, intermediate, and direct. Indirect end users use computers through other people. Intermediate end users specify business information requirements for reports they ultimately receive. Direct end users are those who actually use the terminals.

Sumner and Klepper (Sumner and Klepper, 1987:13) classified end users in three groups: command-level end users, end-user programmers, and functional support specialists.

Finally, Rockart and Flannery (Rockart and Flannery, 1983:778)

classified end users by computer skills into six groups.

1. Nonprogramming End Users whose only access to computer stored data is through software provided by others. They neither program nor use report generators. Access to computerized data is through a limited, menu-driven environment of a strictly followed set of procedures.
2. Command Level Users who have a need to access data on their own terms. They perform simple inquiries often with a few simple calculations such as summation, and generate unique reports for their own purposes. They understand the available database(s) and are able to specify, access, and manipulate information most often utilizing report generators and/or a limited set of commands from languages such as FOCUS, RAMIS II, EXPRESS, SQL, or SAS. Their approach to the computer is similar to that of an engineer to a slide rule in days past. They are willing to learn just enough about the database and the software to assist the performance of their day-to-day jobs in functions such as personnel, accounting, or market research.
3. End User Programmers who utilize both command and procedural languages directly for their own personal information needs. They develop their own applications, some of which are used by other end users. This latter use is an incidental by-product of what is essentially analytic programming performed on a 'personal basis' by quantitatively oriented actuaries, planners, financial analysts, and engineers.
4. Functional Support Personnel who are sophisticated programmers supporting other end users within their particular functional areas. These individuals who, by virtue of their prowess in end-user languages, have become informal centers of systems design and programming expertise within their functional areas. They exist today as 'small pockets of programmers' in each functional organization of the companies we studied. They provide the majority of the code for the users in their functions. In spite of the large percentage of time that these individuals spend coding (several estimated over 80%), they do not view themselves as programmers or data processing (DP) professionals. Rather, they are market researchers, financial analysts, and so forth, whose primary current task is providing tools and processes to get at and analyze data.

5. End-User Computing Support Personnel who are most often located in a central support organization such as an 'Information Center'. Their exact roles differ from company to company. Most, however, are reasonably fluent in end-user languages and, in addition to aiding end users, also develop either application or 'support' software.

6. DP Programmers who are similar to the traditional Cobol shop programmers except that they program in end-user languages. Some corporations have developed a central pool of these programmers to provide service to end-user departments wishing to hire 'contract programmers', to avoid high consultant/programmer fees, and to build a larger base of knowledge of end-user language computing within the corporation.

End-User Support Requirements. In 1988, Systems 3X and AS World conducted a readership survey among 48,406 DP/MIS executives worldwide on the use of personal computers (PCs) (Benedetti, 1988:80). Among other things, they found that 82 percent of the respondents in the accounting department had PCs, nearly 70 percent of personnel in data processing departments had PCs, and corporate management in over 50 percent of the respondents' companies used PCs (Benedetti, 1988:80). The study further showed that nearly 90 percent of the PCs ran spreadsheet applications, 82 percent ran word processing applications, and 67 percent used a database management application. Software specific to the industry was run on 27 percent of the PCs and over 20 percent were used for data collection and bar-code scanning systems (Benedetti, 1988:82). The great variety of applications from a multitude of software vendors requires a great deal of support when end users run into obstacles which prevent them from using the application.

End users require a variety of different types of support from their organizations. Leitheiser and Wetherbe (Leitheiser and Wetherbe, 1986b:343) propose at least 14 types of support activities for end-user computing. Table 1 defines each type of support.

Table 1

## Types of Support

TYPES OF SUPPORT	DEFINITION
1. Advising	Assists in analyzing needs, planning, action, and selecting products or services.
2. Backup	Provide duplicate hardware, software, or data.
3. Compatibility	Insure compatibility of hardware, software, or data.
4. Development	Create or enhance a process, program, product or data set.
5. Documentation	Provide descriptions of how to use a computing resource.
6. Hotline/debugging	Isolate and correct system problems, perhaps through the use of a special phone number.
7. List resource	List the resource (hardware, software, or data) as available to other users.
8. Maintenance	Keep the system in working order; including tests, measurements, replacements, repairs, and adjustments.
9. Data transfer	Move data from one system to another.

Table 1 (continued)

## Types of Support

TYPES OF SUPPORT	DEFINITION
10. Newsletter	Produce and distribute a report on new products or services for users.
11. Purchase	Provide support and assistance for users who are buying their own systems.
12. Recovery	Restore hardware, software, or data after a failure.
13. Research products	Investigate new products and services for possible use by end users.
14. Training	Provide users with the knowledge needed to develop and/or use systems.

The support activities required by end users must be supplied by some type of organizational structure. Leitheiser and Wetherbe (Leitheiser and Wetherbe, 1986b:345) suggest six services which include the 14 activities and can be supplied by a Management Information Systems Department. The services include general consulting, product support, hotline/help desk, technical support, quality assurance, and end-user training. The activities are grouped by service as found in Table 2.



Table 2  
Support Services

SERVICES	ACTIVITIES
1. General Consulting	Advising, development, purchase assistance
2. Product Support	Development, documentation, list resources, maintenance, research new products
3. Hotline/help desk	Hotline/debugging
4. Technical support	Backup, maintenance, data transfer, recovery
5. Quality Assurance	Compatibility, development, documentation
6. User Training	Newsletter, training

Drawbacks to End-User Computing. End-user computing offers many benefits to an organization which helps management make better decisions, however, it also has at least three potential problems. First, there exists an "inability to effectively leverage sophisticated information technologies" (Colligan and Allman, 1986:88). This means companies are not maximizing the benefits the technologies offer. Many times cost/benefit analysis is not completed before the application is developed. Management responsibilities can also suffer as managers get too involved in the finer details of designing and setting up the application.

Another potential problem in end-user computing is the lack of coordination between users, equipment, applications, and data (Colligan and Allman, 1986:88). Users can create many types of applications

within their separate departments which can result in higher costs and inefficiency. Incompatibility problems can surface when hardware is purchased which cannot "talk" to each other. Problems with software applications can also occur when end users develop an application that is incompatible with another department, yet it performs the same function as the application developed in the other department. Data duplication and fragmentation can occur when not coordinated properly. Several departments may generate the same types of data which take up memory and may or may not be updated properly. Also, end users may add new data which is not available to other end users who require it (Colligan and Allman, 1986:88-89).

Unsophisticated end users may cause inefficiencies and difficulties for an organization. Since they are usually not trained as programmers or applications developers, they may waste much time and money or create programs which yield erroneous results (Colligan and Allman, 1986:89).

Management of End-User Computing. Organizations must respond to the demands of end-user computing. Leitheiser and Wetherbe (Leitheiser and Wetherbe, 1986a:9-10) describe four responses. End-users can use one or more of them.

1. Sink or swim - Users perform processing completely on their own.
2. Stick - Users are expected to follow company policies and procedures relating to computing practices and decisions.
3. Carrot - Users are given incentives to follow certain practices and make desirable computing decisions.
4. Service - Users are offered services that meet their computing needs and further overall organizational goals.

There are three general approaches to managing end-user computing: monopolistic, laissez-faire, or the information center (Gerrity and Rockart, 1986:28). In the monopolistic approach, the Information Systems organization attempts to maintain firm control over all end-user computing by limiting it severely. The laissez-faire approach is just the opposite. User-managers are allowed to purchase whatever resources they please, provided they have their own budget.

The information center approach attempts to provide a focused managerial approach to end-user computing (Gerrity and Rockart, 1986:28). The functions of the information center can vary significantly.

#### The Information Center

Definition. Information center (IC) is a generic name for a functional unit which provides assistance to computer users. This functional unit may also be known as "end-user computing center, information resource management, computer resource center, and user support services" (Arnoudse and Ouellette, 1987:9). Goldstein (Goldstein, 1987) provides a clear, concise definition of an information center.

The Information Center is a specially designed facility along with the group of people who work within it that provides the organization with technical support for local computing applications. These local computing applications, also known as 'end-user computing' applications, are an extension of the personal computers that individuals have brought into their companies to support their own computing needs. (p. 77)

In the relevant literature, ICs are generally defined by the specific functions performed which are not universal and have also

changed over time. However, for the purposes of this paper, an IC will be defined as a means to manage end-user computing.

The IC Model: IBM, Canada. It is generally agreed that the information center concept evolved about 1974 at IBM (Carr, 1987:326; Goldstein, 1987:77; Hartman, 1987:56). IBM established the information center to alleviate the backlog of requests for development of information systems. This backlog, according to Alloway and Quillard, as reported by Carr (Carr, 1987:326), was between two and three years for formal development requests. They further estimated an "invisible demand" 535 percent greater than the formal request backlog. This "invisible demand" consisted of desired, but not formally requested, systems development projects.

The first information center was reported by L. W. Hammond (Hammond, 1982) in the IBM Systems Journal in 1982. Hammond described an IC as

...a portion of the Information Systems (IS) development resource organized and dedicated to support the users of IS services in activities such as report generation and modification, data manipulation and analysis, spontaneous inquiries, etc. (p, 131)

The objective of an IC is to provide users access to data on their own terms so that they can solve their own business problems. It is typically accomplished by providing a set of packaged tools and data availability (with appropriate training and consulting support) to the users enabling them to gain the power of the computer in a relatively easy and timely fashion. (p. 133)

The IC provided the following seven services: training, user assistance, usage planning, product evaluation, consulting, security, and marketing (McNurlin and Sprague, 1989:326).

During this period, the typical end user used the IC to access the corporate database to conduct a one-time query or to create a special,

non-standard report. The data residing on mainframe computers was accessed via terminals in the IC by users with the help of the IC staff (Hammond, 1982:134; McNurlin and Sprague, 1989:328).

Table 3 identifies the personnel requirements of an IC along with the responsibilities of each position. (Hammond, 1982:135)

Table 3  
IC Personnel Requirements

POSITION	RESPONSIBILITIES
IC Manager	Personnel management, planning, projection and control of resources, development of tactical plans, interfacing
Analyst or Consultant	Help users prepare support requests, evaluate alternatives, and channel support requests to appropriate sources
Product Specialist	Help users define a solution for their problem within the constraints of the packages they support
Administrative Support	Secretarial support, control of educational facilities and schedules, keeping manuals up to date, preparation and distribution of newsletters
Technical Support	Installation and maintenance of packages (software applications) supported
Teacher	Development and presentation of materials on the IC and the packages it supports

Proliferation of ICs. In August 1981, IBM introduced the IBM Personal Computer (PC). This revolutionary computer was the first micro-

computer to break the barrier of 64 kilobytes of internal memory. In March 1983, IBM announced its new PC/XT with nine times the memory capacity of the PC, a hard drive, a color monitor, and a communications adapter to connect to other IBM computers (Chposky and Leonsis, 1988:139).

The number of information centers grew rapidly in the first half of the 1980s. A study by the American Management Association estimated that by 1985, one-third of the organizations in the United States had implemented the information center concept (Bergeron and others, 1990:247).

Services. To meet the support needs of a growing end-user clientele, information centers expanded the number of services provided. Table 4 presents an analysis of information center services from a 1984 study conducted by Leitheiser and Wetherbe (Leitheiser and Wetherbe, 1986:10-11) for the Management Information Systems Research Center. These services coincide closely with the support requirements this same team identified in 1986.

Table 4  
Analysis of Information Center Services

SERVICES	PERCENTAGE OF ICS OFFERING SERVICES
Consulting	100%
Training	95%
Troubleshooting	95%
Research	95%
Other	70%
Office Automation Support	
Electronic Mail	
User's Groups	
Departmental Needs Assessment	
Coordinate End-User Data Access	
User Advocate With DP Department	
Document and Distribute End-User	
Software	
Development	65%
Data Extraction	63%
Newsletter	61%

IC Stages. Magal (Magal and other, 1988:414-419) hypothesized four stages of information center evolution and validated the hypothesis by surveying 311 information center directors. The directors were also asked to indicate the current stage of their center and the amount of time spent in each preceding stage. Those centers currently in Stage II had spent an average of 12 months in Stage I. Those centers currently in Stage III had spent 10.8 months in Stage I and 15.8 months in Stage II. Only eight percent of the centers were in Stage IV and indicated an average of 10.5 months in Stage I, 13.2 months in Stage II, and 12.3 months in Stage III.

Initiation. Stage I occurs in answer to increased micro-computer use or introduction of micro-computer use to the organization. The goal of the information center in this stage is to support and

control end-user computing. Micro-computer use is not yet pervasive and little demand is placed on the center's resources. The center's small staff experiments with various training methods. There are few if any policies, procedures, or strategies developed (Magal and others, 1988:416).

Expansion. Stage II is characterized by increased numbers of users, hardware, software, and applications. New users require basic computer instruction while the users from Stage I are ready for advanced instruction. Micro-computer use expands in volume as well as variety of application. Demands placed on the center are therefore dramatically increased (Magal and others, 1988:416).

Formalization. Stage III begins as the runaway growth of Stage II reaches the crisis point. As might be expected, the stage's primary objective is control. Information center management establishes policies and procedures for system acquisition, budget expenditures, and work priorities. The information center's staff continues to grow and begins to specialize into areas of management, administration, training, and other areas of user support. The information center itself may become decentralized into smaller information support centers within some departments of the organization (Magal and others, 1988:417).

Maturity. Stage IV continues the decentralization of the information center begun in Stage III. A hierarchy of information centers emerges with the original information center now at the senior executive level. The focus now is to provide policies and procedures and to develop strategic applications to support the organization's goals (Magal and others, 1988:417).



Critical Success Factors. Building upon the work of several other researchers, Magal, Carr, and Watson (Magal and others, 1988:419-421) investigated the critical success factors applicable to information centers and their significance in each IC stage.

Table 5 describes the original 26 critical success elements grouped into five factors.

Table 5

IC Critical Success Factors

- 
- |           |  |
|-----------|--|
| Factor 1: | Commitment to the IC Concept <ul style="list-style-type: none"><li>- Top management support</li><li>- Promote IC services</li><li>- Organizational acceptance of IC concept</li><li>- Commitment of end users to the IC concept</li><li>- Career paths for IC staff</li></ul>  |
| Factor 2: | Quality of IC Support Services <ul style="list-style-type: none"><li>- A competent staff</li><li>- Support software packages</li><li>- End-user training</li><li>- Reliability of applications developed</li><li>- Standardized hardware and software</li><li>- Training for IC staff</li></ul>                                  |
| Factor 3: | Facilitation of End-User Computing <ul style="list-style-type: none"><li>- Communication with users</li><li>- Cost-effective solutions</li><li>- Atmosphere for users</li><li>- Understanding user's business and problems</li><li>- Manage end-user expectations</li><li>- Liaison function with end-user departments</li></ul> |
| Factor 4: | Role Clarity <ul style="list-style-type: none"><li>- Provide services to distributed sites</li><li>- Define IC mission</li><li>- User understanding of data processing</li><li>- Chargeback criteria</li><li>- Control procedures to ensure standards, policies, etc. are adhered to</li></ul>                                   |

Table 5 (continued)

IC Critical Success Factors

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Factor 5: Coordination of End-User Computing
- Priority criteria for work
- Monitor and coordinate end-user applications development
- Respond to application requests
- System performance

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Further analysis to ascertain the relative significance of each of the five composite critical success factors indicated that

...they are not equally important. The quality of IC support is the most important, followed by facilitation of end-user computing, commitment to the IC concept, role clarity, and coordination of end-user computing. With few exceptions (e.g., role clarity and coordination of end-user computing in Stage 1) this rank ordering remains the same through all stages. (Magal and others, 1988:423)

Summary

End-user computing became a phenomenon in the 1970s and 1980s due to Information Systems Department backlogs and the proliferation of the personal computer. Several groups of end users evolved with a variety of support requirements. Organizations responded with several approaches, but three methods gradually evolved. The most successful method was the information center.

It has been recognized that resisting the growth of user development is a losing battle and is not in the best interests of organizational growth and development. (Sipior and Sanders, 1989:122)

### III. Methodology

#### Introduction

This chapter discusses the methodology used to meet the research objective. The survey instrument is justified and each question in the survey is presented. The method for pretesting and validating the survey instrument and the sample selection are discussed. Details of the data collection plan and the data analyses are discussed.

#### Test Hypothesis

The following are the test hypotheses required to meet the research objective:

Hypothesis 1. End users in the Air Force are similar to end users in civilian organizations with information centers and to end users in civilian organizations that do not have information centers.

Hypothesis 1a. The distribution of men and women in all three samples is not significantly different.

Hypothesis 1b. The age distribution in all three samples is not significantly different.

Hypothesis 1c. The distribution of end users' educational levels is the same for all three samples.

Hypothesis 1d. The number of end users in the three samples is not significantly different with regard to their job and placement level within the organization.

Hypothesis 1e. The length of time end users in each of the three samples have used a computer is similar.

Hypothesis 1f. The distribution of the amount of formal computer education is not significantly different between the three samples.

Hypothesis 1g. There is no significant difference between end users in each of the samples in the confidence they have in their ability to use various computer applications.

Hypothesis 1h. The types of applications used do not vary significantly among the samples.

Hypothesis 1i. There is no significant difference among the samples regarding who uses the results of end user's computing.

Hypothesis 1j. End users in each of the three samples agree on the effect that using a computer has had with regard to the quality and quantity of their work.

Hypothesis 1k. There is no significant difference in the levels of confidence end users in each of the three samples have in using a computer to meet the needs of their job.

Hypothesis 1l. End users in each of the samples agree on the amount of increased productivity they would realize with stronger computer skills.

Hypothesis 2. End users in each of the three samples have similar support needs.

Hypothesis 3. There is no significant difference in the importance end users in each sample place on each type of support.

Hypothesis 4. There is no significant difference between end users in each sample in their choice of the source of support.

Hypothesis 5. End users in each sample are equally satisfied with the support they receive from each source of support for each type of support.

Hypothesis 6. An information center is the best source of support for meeting the needs of end users.

### Research Design

General Description. This research was conducted through a survey designed by the authors. Three samples of end users were surveyed with the intent of comparing the types of support end users require, their sources of support, their level of satisfaction with the source of support, and how important that type of support is to the end user.

Survey Justification. There are three advantages to using mail surveys versus telephone interviews: lower costs, increased access to respondents, and anonymity (Emory, 1985:172). In this research, the sample is widely dispersed. Additionally, the number of respondents exceeds 400. Interviewing that many respondents would be a difficult, if not impossible, task. Therefore, mail surveys were the more cost effective method in terms of money and time.

The second advantage, increased access to respondents, is applicable to this study. Some of the end-user respondents selected may have been difficult or impossible to reach by phone. These respondents may include high-level executives, flight-line supervisors, or shop chiefs.

Compared to a telephone interview, the mail survey is generally perceived by the respondent as more impersonal and it provides more anonymity (Emory, 1985:172). Discussions with Management Information

Systems (MIS) directors in the civilian organizations revealed a higher level of sensitivity toward the anonymity issue and, in some cases, was a prerequisite for participation in the research.

Emory also lists two disadvantages to mail surveys, nonresponse and the inability to probe for depth of response (Emory, 1985:172). Methods to encourage response to the survey instrument were employed. Return envelopes with postage already affixed were supplied to each civilian survey respondent. A letter of introduction and advance call were made to each organization to ensure their participation in the research. After the surveys were distributed, follow-up calls were made to those organizations with response rates less than 30 percent. Emory (Emory, 1985:172) says a response rate of 30 percent is considered satisfactory. Depth of response is not as important to this study as responding to every question. The information requested is either factual or an opinion that can be made without a great deal of thought or a need to clarify the question. Responding to every question is important because many of the questions are logically related.

Research Instrument. The questions in Part One of the survey are designed to identify characteristics of end users: educational background, experience computing, types of applications used, effects of computing on quality and quantity of work output, and current confidence level in computing skills. Analysis of the responses to these questions for each sample provides a basis by which to compare end-user support needs, satisfaction levels, and evaluation of the importance of different types of support.

The responses for Question 4 represent various organizational levels as described by Henry Mintzberg in The Structuring of Organizations: A Synthesis of the Research (Mintzberg 1979:25-31).

The responses to Question 5 reflect, in part, the 18-month effect described in Information Systems Management. "During the first months of usage of a new technology, most people use it to do familiar tasks more easily. In the case of a personal computer, this might mean using it only for word processing or for spreadsheet calculations, for example. Then, after a period of time, averaging about eighteen months, said Hiltz and Turoff, users become more confident and they are willing to try new applications." (McNurlin and others, 1989:322)

Part Two of the survey asks four basic questions for each of the 14 types of support identified by Leitheiser and Wetherbe. (Leitheiser and Wetherbe, 1986b:343) The four basic questions are as follows:

1. Did you receive "xxxxx" support in the past six months?
  - A. Yes.
  3. No.
2. Where did you receive that support?
  - A. Computer user support office.
  - B. Information center.
  - C. Co-worker.
  - D. Friend outside of work.
  - E. Vender/consultant.
  - F. Other (fill in on the form)\_\_\_\_\_.
3. Please rate your level of satisfaction with the source of this support.
  - A. I did not need this type of support.
  - B. I needed this support but could not get it.
  - C. Excellent.
  - D. Good.
  - E. Fair.
  - F. Poor.
  - G. Very poor.

4. How much importance do you place on "xxxxxx" support?
- A. Very low importance.
  - B. Low importance.
  - C. Moderate importance.
  - D. High importance.
  - E. Very high importance.

The full survey and survey response form are included in Appendix A.

Survey Validation. The survey validation phase was primarily concerned with content validity. Emory says "the content validity of a measuring instrument is the extent to which it provides adequate coverage of the topic under study" (Emory, 1985:95). One way to determine content validity is through a careful definition of the topic of concern, the items to be scaled, and the scales to be used. In this case, a thorough review of the literature and a logical and carefully designed research question led to comprehensive measurement questions. "A second way to determine content validity is to use a panel of persons to judge how well the instrument meets the standards" (Emory, 1985:95). The survey was administered to 26 civilian students and 20 graduate students located in Dayton, Ohio. They were told their participation was voluntary and they would remain anonymous. They were also asked to make any comments that would improve the survey instrument. Twenty surveys were returned and the overall return rate was 43 percent. As a result, several questions in Part One were rearranged in an order that would allow the survey respondent to progress from simple to more complex questions. The questions in Part Two were reorganized to reduce confusion and increase responses to individual questions on the part of the survey respondent.



Population Descriptions. There are three populations used in this research: civilian organizations with information centers; civilian organizations without information centers; and Air Force bases. The Air Force bases are considered not to have an information center.

The intent of this research was to match civilian organizations as closely to Air Force bases as possible. After much consultation, industrial organizations were deemed the most appropriate match in the judgement of the researchers. The 1990 Ohio Industrial Directory contained detailed lists of industrial organizations by city. Both civilian samples were located in Dayton, Ohio, primarily to enhance the ease with which the survey could be administered. Two civilian organizations with information centers received 60 surveys and seven civilian organizations without information centers received 205 surveys. The imbalance in the number of surveys distributed was due to the difficulty in finding organizations with information centers in the Dayton area.

The Air Force bases included in this research were assigned to Strategic Air Command (SAC), Tactical Air Command (TAC), and Military Airlift Command (MAC). They were single-wing installations in the continental United States without a higher headquarters unit assigned. They have maintenance, supply, operations, and support functions. Each base received 150 surveys for a total of 450 surveys. The number of surveys distributed totalled 715.

Sampling Techniques. The two civilian samples were selected from the Ohio Industrial Directory through a process of nonprobability selection. Nonprobability selection is nonrandom because each member did not have a known nonzero chance of being included (Emory, 1985:278).

The military bases in the Air Force sample were also selected through nonprobability selection. Some of the reasons for using nonprobability sampling are the savings in cost and time, ease of application, and feasibility (Emory, 1985:279). Nonrandomly selecting civilian organizations and military bases was easier, incurred less cost and time, and was more feasible due to the large number of entities available. Even if a random selection were made, getting the organizations' participation was exceedingly difficult due to the chain of command protocols necessary for approval. As it was, if an organization or base was willing to participate, they were selected. Some organizations would not participate under any conditions. Locating civilian organizations without information centers was not a difficult problem. Locating those with an information center presented a very difficult problem. These organizations were identified primarily through the knowledge of MIS directors in the other civilian organizations.

Once the organizations and bases were selected, the task of selecting survey participants was addressed. End users in the Air Force are identified by a letter of authorization for each computer. A copy of this letter of authorization is also maintained by each unit's Computer Systems Security Officer (CSSO) or Computer Equipment Account Custodian (CEAC). A list of each unit's CSSO or CEAC is maintained by the base's micro-computer manager or Computer Security Officer. The micro-computer manager or Computer Security Officer from each of the three bases was contacted. All three agreed to distribute the surveys according to instructions, collect the completed surveys, and return them by mail. At the TAC base, each CEAC was directed to select the first letter of authorization in his or her file, select the fifth name

on the list, and forward the survey to that individual. At the MAC base, each CSSO received three surveys with instructions to forward them to the fifth name on the first three letters of authorization in file. At the SAC base, each CSSO received two surveys which were to go to the fifth name on the first two letters of authorization. Each CSSO or CEAC was directed to select the next name on the list if the person with the fifth name was on leave, serving temporary duty elsewhere, or was a civilian. The survey was not approved for distribution to Department of Defense civilian employees. To gain this approval required additional levels of review and time became a limiting factor.

End users in civilian organizations are generally not formally identified like those in the Air Force. Given enough time and money, a list may have been produced from which a random selection could have been made, however, the MIS directors preferred to select respondents and administer the survey themselves. The surveys were delivered to all civilian organizations and the MIS directors or survey administrators were carefully briefed to select respondents from a wide range of end users in the organization. The respondents should not all be the best computer users or those with the best work attitudes. A cross section of all end users should be represented to the best of the ability of the MIS director. The MIS directors all signalled their understanding. Subsequently, the respondents were chosen through the process of nonprobability selection.

Data Collection. The survey instrument was approved by the Air Force Manpower and Personnel Center and assigned Survey Control Number 91-42, expiration 1 October 1991. (The survey approval request letter is included in Appendix B.) With 715 surveys administered, it was

advantageous to use an optical scan form to compile the data. The Air Force Institute of Technology (AFIT) Form 11E, AFIT Data Collection Form, was selected for use by all survey respondents.

Each survey participant received a survey, AFIT Form 11E, cover letter, and return envelope. Return envelopes for civilian participants were preaddressed with postage affixed. Surveys were mailed to the project officer at each Air Force base who also collected the completed surveys and mailed them back to the researchers. Surveys were not mailed to civilian organizations. Instead, they were hand-delivered to take advantage of personally speaking with MIS directors and survey administrators. Additionally, any questions concerning administration of the survey were addressed at this sitting. Survey respondents in the civilian organizations simply had to complete the survey and return it in the stamped envelope.

### Decision Criteria

Although the role of information centers is evolving beyond merely end-user support, end-user support continues to be one of the main objectives of information centers. To ensure the maximum productivity of end users and the maximum utility of both information and computer equipment resources, end-user support should also be a main objective of organizations. End-user satisfaction will be used as the measure of success in meeting this objective. End-user satisfaction has been used extensively as a measure of success in end-user computing (Bergeron and Berube, 1988; Doll and Torkzadeh, 1988; Rivard and Huff, 1988; Bailey and Pearson, 1983).

### Data Analysis

After the survey response forms were optically scanned, two additional data files were created, one in SAS and one in Oracle. The data was then analyzed as outlined in Table 6. The level of significance, where applicable, was .10.

Table 6  
Data Analysis Techniques

QUESTION	ANALYSIS
001. Indicate your sex.	Percentages by sample. Chi square comparisons.
002. Find the number below that includes your age.	Percentages by sample. Chi square comparisons.
003. Indicate the highest level of education you have achieved.	Percentages by sample. Chi square comparisons.
004. Select the statement below that best describes you in your work environment.	Percentages by sample. Chi square comparisons.
005. How long have you used a computer on or off the job?	Percentages by sample. Chi square comparisons.
006. Indicate the highest level of computer training you have completed.	Percentages by sample. Chi square comparisons.

Table 6 (continued)

## Data Analysis Techniques

QUESTION	ANALYSIS
Rate how confident you feel using that application.	Percentages by sample. using the application. Chi square comparisons.
007. Database.	Percentages by sample
008. Word Processing.	of confidence levels of
009. Spreadsheets.	those who use the
010. Graphics.	application.
011. Telecommunications.	Percentages by sample of combinations of applications used.
For the next five questions, specify and rate your confidence with other applications you use, such as CAD, CAM, simulations, engineering, scientific, program or project management.	Summary of responses provided.
012. - 016.	
017. Who uses the results of your computing most often?	Percentages by sample. Chi square comparisons.
018. Has using a computer improved the quality of your work?	Mean and standard deviation by sample. ANOVA and REGWF test.
019. Would your supervisor agree with your answer to Question 018?	Percentages by sample. Chi square comparisons.
020. Has using a computer increased the quantity of your work?	Mean and standard deviation by sample. ANOVA and REGWF test.
021. Would your supervisor agree with your answer to Question 020?	Percentages by sample. Chi square comparisons.

Table 6 (continued)

## Data Analysis Techniques

QUESTION	ANALYSIS
022. How much confidence do you have using your computer to meet the needs of your job?	Mean and standard deviation by sample. ANOVA and REGWF test.
023. Do you feel that you could be more productive in your job if you had stronger computer skills?	Mean and standard deviation by sample. ANOVA and REGWF test.
Did you receive "xxxxx" support in the past six months?	Percentages by sample. Chi square comparisons.
024A. Advising	
027A. Backup	
030A. Compatibility	
033A. Development	
036A. Documentation	
039A. Hotline/Debugging	
042A. Listing of Resources	
045A. Maintenance	
048A. Data Transfer	
051A. Newsletter	
054A. Purchase Assistance	
057A. Recovery	
060A. Research Products	
063A. Training	

Table 6 (continued)

## Data Analysis Techniques

QUESTION	ANALYSIS
Where did you receive that support?	Percentages by sample by source of support for those end users receiving that support.
024B. Advising	Chi square comparisons.
027B. Backup	
030B. Compatibility	
033B. Development	
036B. Documentation	
039B. Hotline/Debugging	
042B. Listing of Resources	
045B. Maintenance	
048B. Data Transfer	
051B. Newsletter	
054B. Purchase Assistance	
057B. Recovery	
060B. Research Products	
063B. Training	
Please rate your level of satisfaction with the source of support.	Mean and standard deviation by source of support for those end users receiving that support.
025. Advising	ANOVA and REGWF test.
028. Backup	
031. Compatibility	
034. Development	
037. Documentation	
040. Hotline/Debugging	
043. Listing of Resources	
046. Maintenance	
049. Data Transfer	
052. Newsletter	
055. Purchase Assistance	
058. Recovery	
061. Research Products	
064. Training	



Table 6 (continued)  
Data Analysis Techniques

QUESTION	ANALYSIS
How much importance do you place on "xxxxx" support?	Mean and standard deviation by sample. ANOVA and REGWF test.
026. Advising	
029. Backup	
032. Compatibility	
035. Development	
038. Documentation	
041. Hotline/Debugging	
044. Listing of Resources	
047. Maintenance	
050. Data Transfer	
053. Newsletter	
056. Recovery	
062. Research Products	
065. Training	

The Ryan-Einot-Gabriel-Welsch F test (REGWF test) was used to control the Type I experimentwise error rate. An ANOVA was used to identify p values.

### Summary

A mail survey was chosen as the most cost effective and most appropriate measurement instrument for this study. The questions in the survey were presented and validated through a pretest. Each of the three sample populations were identified, justified, and the sample selections from the populations were outlined. The data collection plan was presented and the data analysis plan were explained and justified.

#### IV. Data Analysis

##### Introduction

The purpose of this study is to determine whether or not an information center is an appropriate means of providing support to end users in the Air Force. This chapter presents the results of the research and is structured in terms of the six research hypotheses defined in Chapter I.

Population Samples. Table 7 shows the survey response rates for each of the three research samples. The return rate for all three samples exceeds 30 percent which, according to Emory (Emory, 1985:172), is considered satisfactory.

Table 7  
Survey Response Rates

SAMPLE	NO. REQUESTED	NO. RETURNED	RETURN RATE
Air Force	450	258	57.33
Civilian Without IC	205	114	55.61
Civilian With IC	60	44	73.33

##### Research Results

Chi square analysis tables, where applicable, are presented in Appendix E. Tables displaying the means and standard deviations are contained in Appendix F, and percentage distribution tables are shown in Appendix G.

Hypothesis 1. End users in the Air Force are similar to end users in civilian organizations with information centers and to end users in civilian organizations that do not have information centers.

Based on the results of the subordinate hypotheses, Hypothesis 1 is rejected.

Hypothesis 1a. The distribution of men and women in all three samples is not significantly different.

A chi square comparison of the three samples on this factor indicates no significant difference between the two samples from civilian organizations. However, the Air Force sample is significantly different from both of the civilian samples. The ratio of men to women in the Air Force sample is nearly four to one. The ratio in the civilian sample without information centers is nearly one to one, and in the civilian sample with information centers, the ratio is two to three. Figure 1 shows the relative frequency distribution of men and women in each sample.

Hypothesis 1a is therefore rejected.

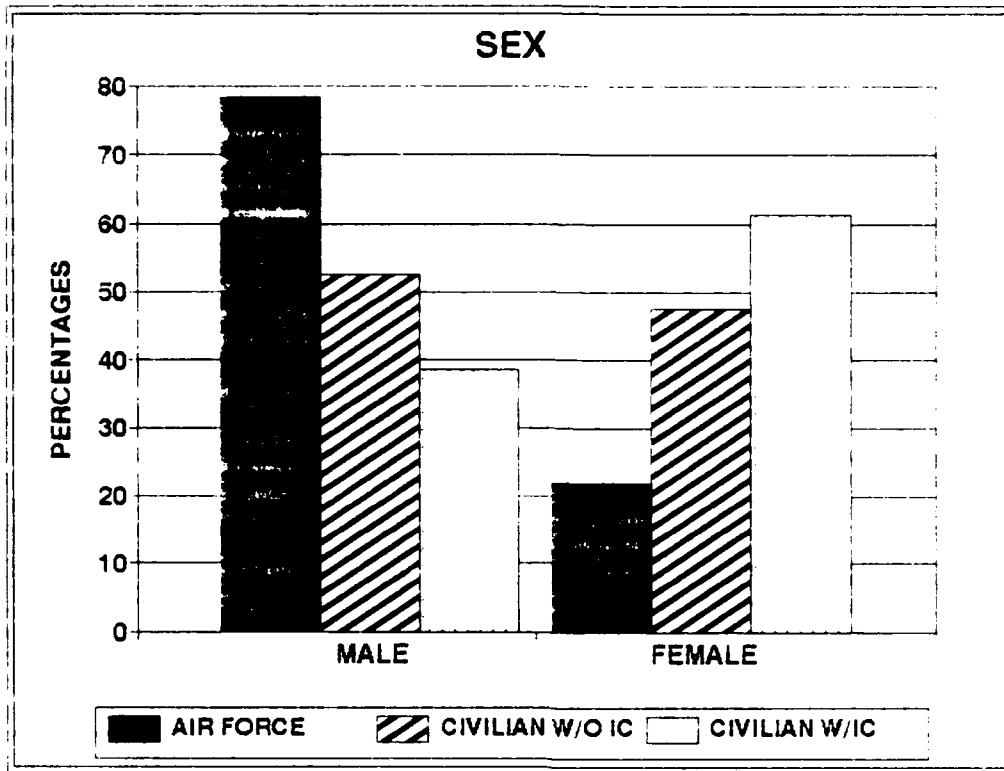


Figure 1. Relative Frequency Distribution of Gender in Each Sample

Hypothesis 1b. The age distribution in all three samples is not significantly different.

Comparison of the age distribution between the three samples shows that Air Force end users are much younger than their civilian counterparts. While less than 10 percent of the Air Force sample was over the age of 40, the percentage of end users over 40 was approximately the same as the percentage of end users under 40 in both of the civilian samples. The relative frequency distribution for the three samples is given in Figure 2.

Hypothesis 1b is rejected.

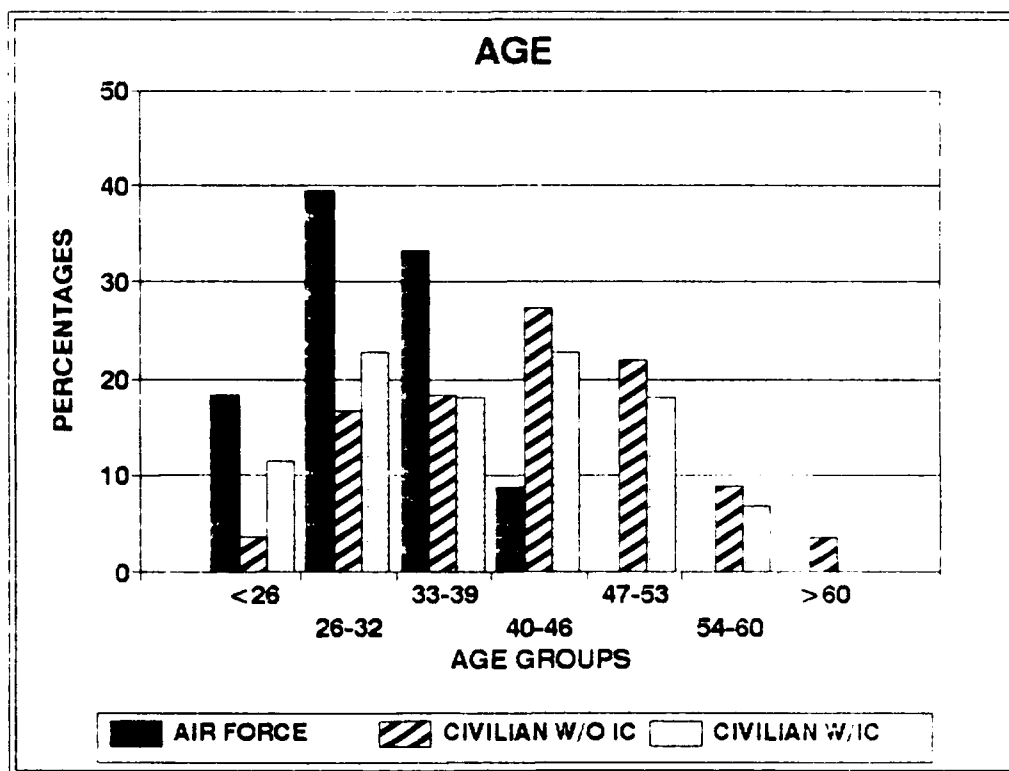


Figure 2. Relative Frequency Distribution of Age Categories in Each Sample

Hypothesis 1c. The distribution of end user educational levels is the same in all three samples.

Civilian end users are more highly educated than Air Force end users. The percentage of end users in each of the civilian samples with a bachelor degree or higher was twice as high as that in the Air Force. There were no responses in any of the samples to less than a high school diploma. Figure 3 is a graphical representation of the relative frequency distribution of educational levels.

Hypothesis 1c is rejected.

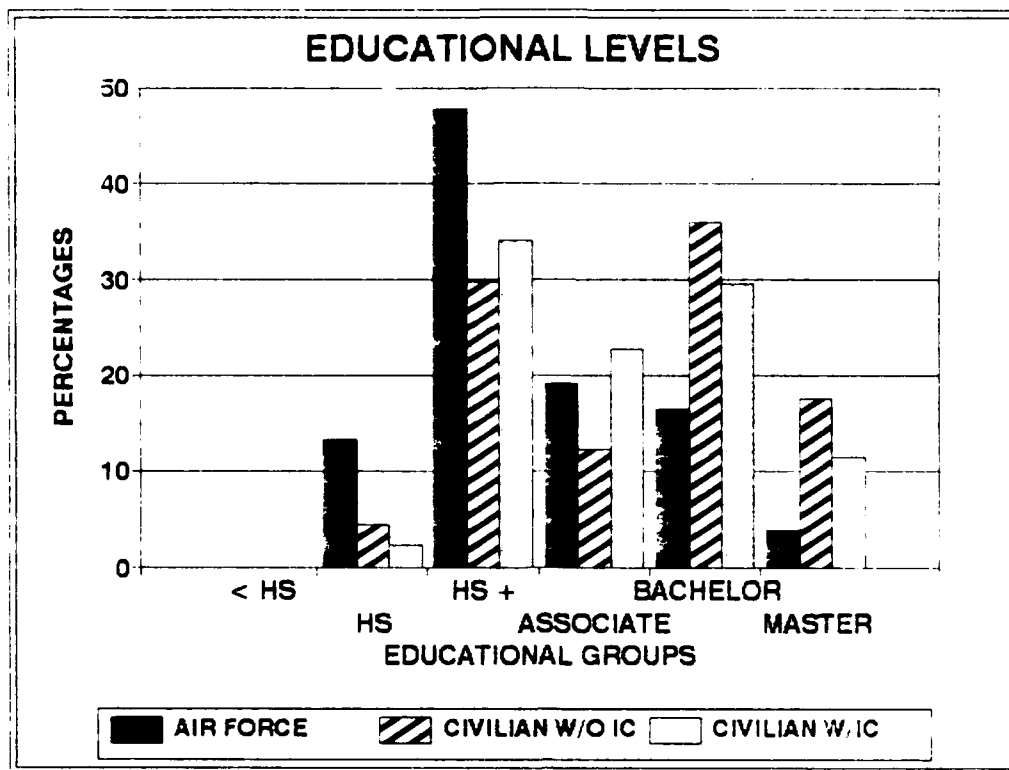


Figure 3. Relative Frequency Distribution of Educational Levels for Each Sample

Hypothesis 1d. The number of end users in the three samples is not significantly different with regard to their job and placement level within the organization.

The majority (over 75 percent) of Air Force end users occupy the operational levels of the organization compared to less than half of the end users in the two civilian samples. Figure 4 shows the relative frequency distribution for all three samples.

Hypothesis 1d is rejected.

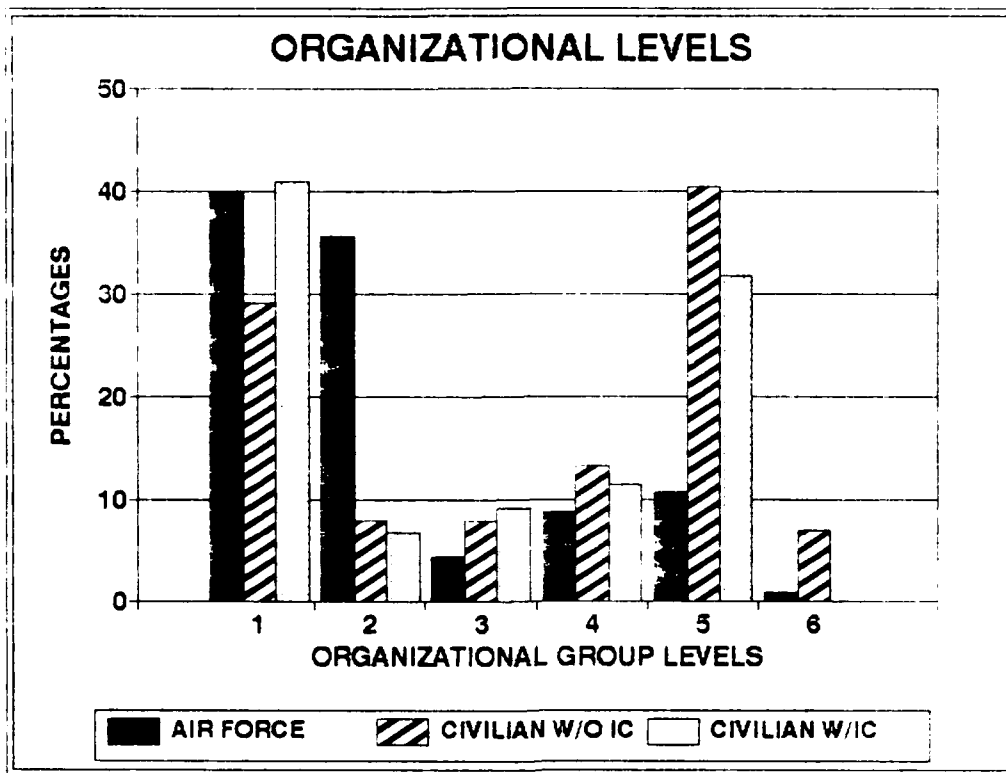


Figure 4. Relative Frequency Distribution of Work Levels for Each Sample

Hypothesis 1e. The length of time end users in each of the three samples have used a computer is similar.

The percentage of Air Force end users with three years experience or less was nearly four times greater than the percentage in each of the two civilian samples. Figure 5 portrays the relative frequency distribution for each of the three samples.

Hypothesis 1e is rejected.

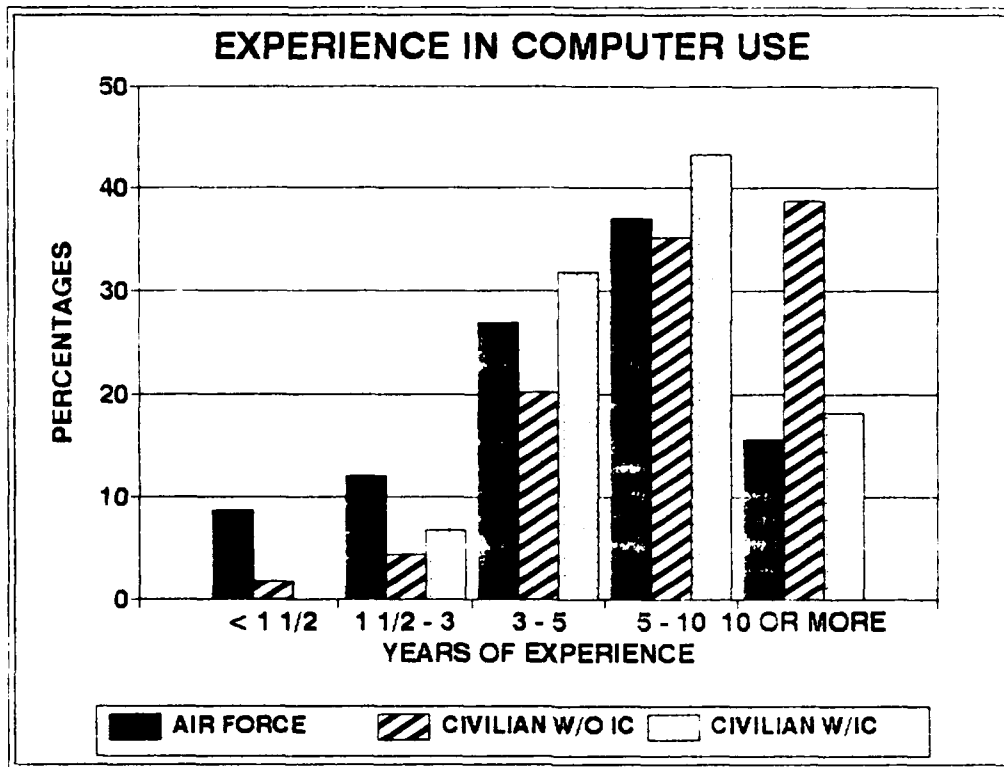


Figure 5. Relative Frequency Distribution of Length of Computer Use for Each Sample

Hypothesis 1f. The distribution of the amount of formal computer education is not significantly different between the three samples.

Twice as many end users in civilian organizations without information centers have not had any formal computer education than end users in civilian organizations with information centers. This ratio is three to one between the Air Force and civilian organizations with information centers. Figure 6 graphically displays the relative frequency distribution for all three samples.

Therefore, Hypothesis 1f is rejected.



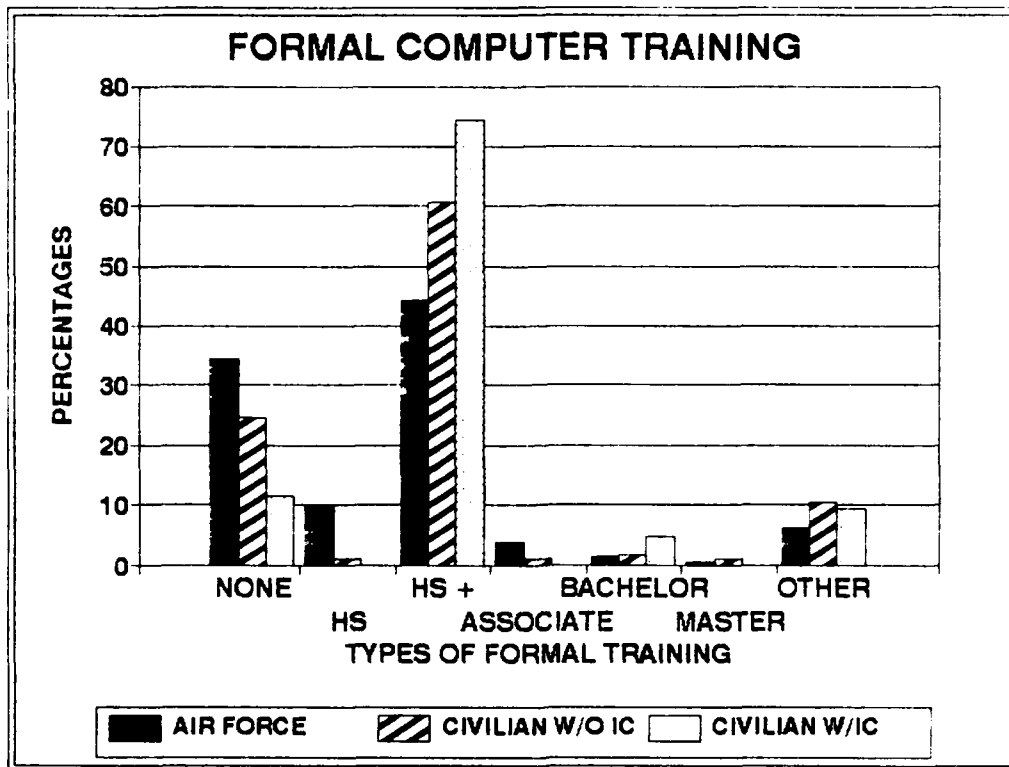


Figure 6. Relative Frequency Distribution of Formal Computer Education for Each Sample

Hypothesis 1g. There is no significant difference between end users in each of the samples in the confidence they have in their ability to use various computer applications.

Based on the analyses presented below, Hypothesis 1g is accepted.

Databases. The relative frequency distribution of the four levels of confidence, as shown in Figure 7, shows very little difference among the three samples.

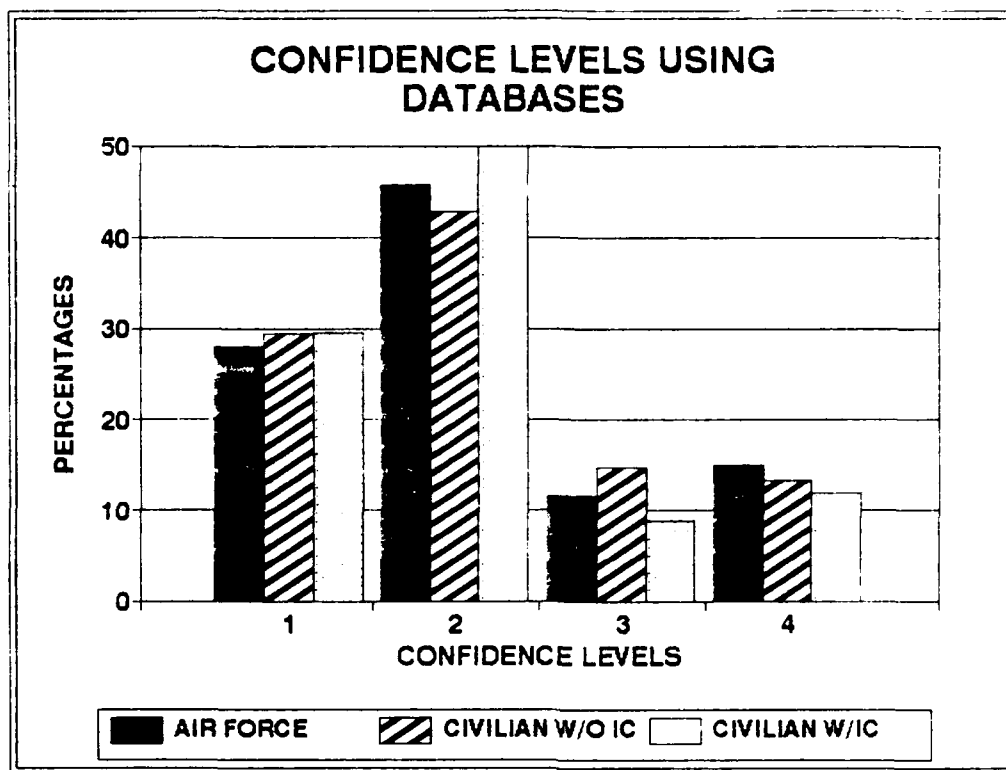


Figure 7. Relative Frequency Distribution of Confidence in Using Databases for Each Sample

Word Processors. A chi square comparison of the confidence levels using word processors showed no significant difference between Air Force end users and end users in civilian organizations with information centers. However, the majority of end users in civilian organizations without information centers expressed significantly lower levels of confidence. Figure 8 shows the comparison of confidence levels between the three samples.

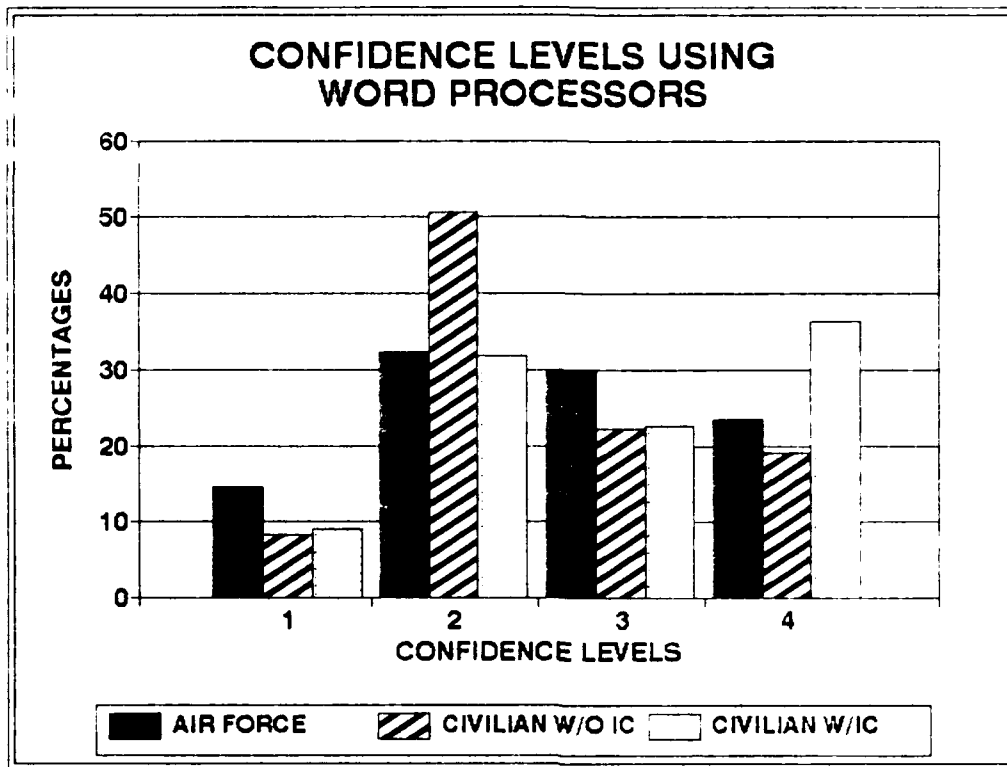


Figure 8. Relative Frequency Distribution of Confidence in Using Word Processors for Each Sample

Spreadsheets. Chi square comparisons among the three samples showed no significant difference in the levels of confidence end users expressed in using spreadsheets. Figure 9 shows the relative frequency distribution for all three samples.

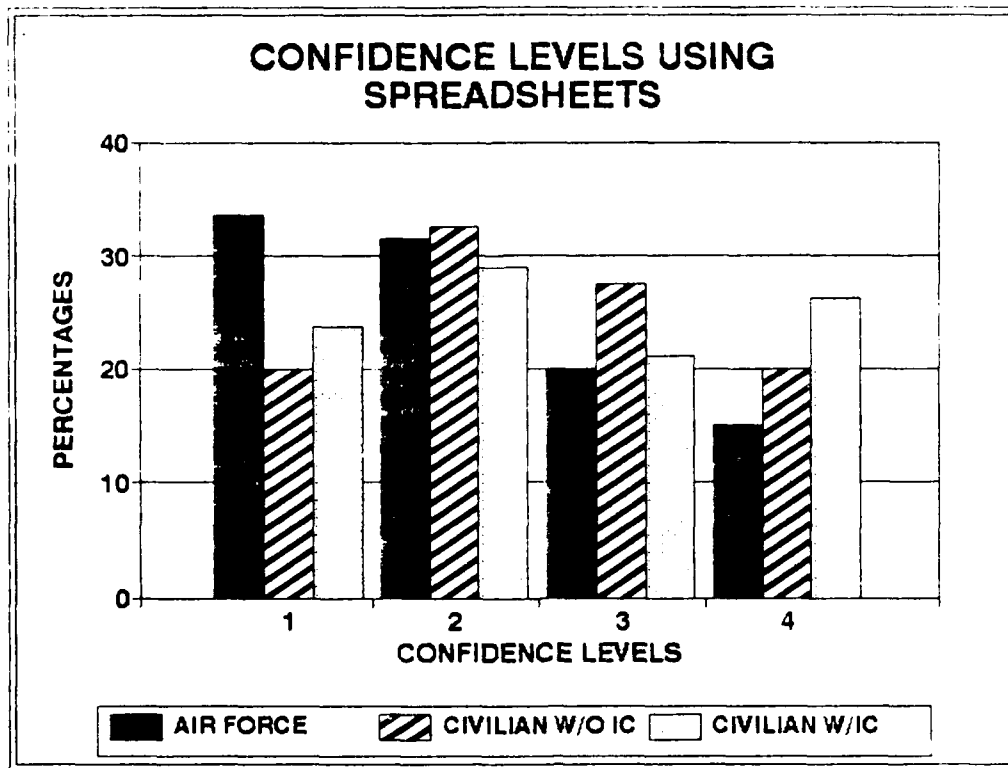


Figure 9. Relative Frequency Distribution of Confidence in Using Spreadsheets for Each Sample

Graphics. Chi square comparisons between end users in the Air Force and civilian organizations without information centers and between the two civilian samples showed no significant difference in levels of confidence using graphics. Figure 10 shows the relative frequency distribution of confidence levels for all three samples.

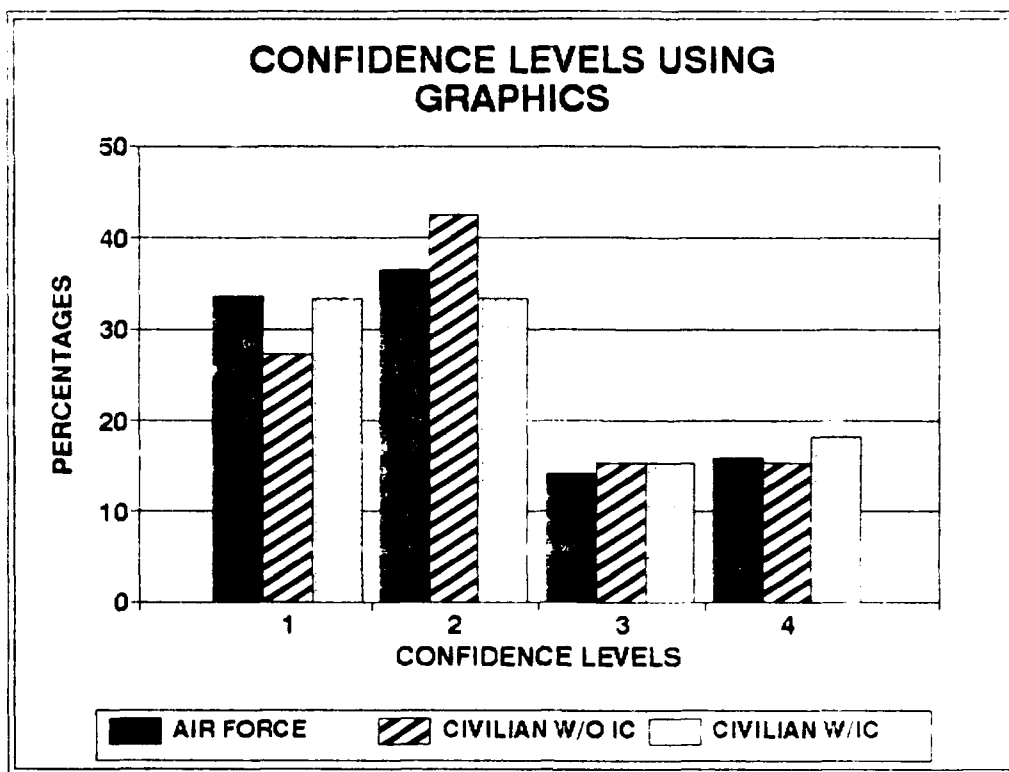


Figure 10. Relative Frequency Distribution of Confidence in Using Graphics for Each Sample

Telecommunications. A chi square comparison of the confidence levels using telecommunications between the Air Force and civilian organizations without information centers showed no significant difference. While this was the only chi square comparison that could be made, there is relatively little difference in the percentage distribution of confidence levels among the three samples. Figure 11 shows this relative frequency distribution of confidence levels.

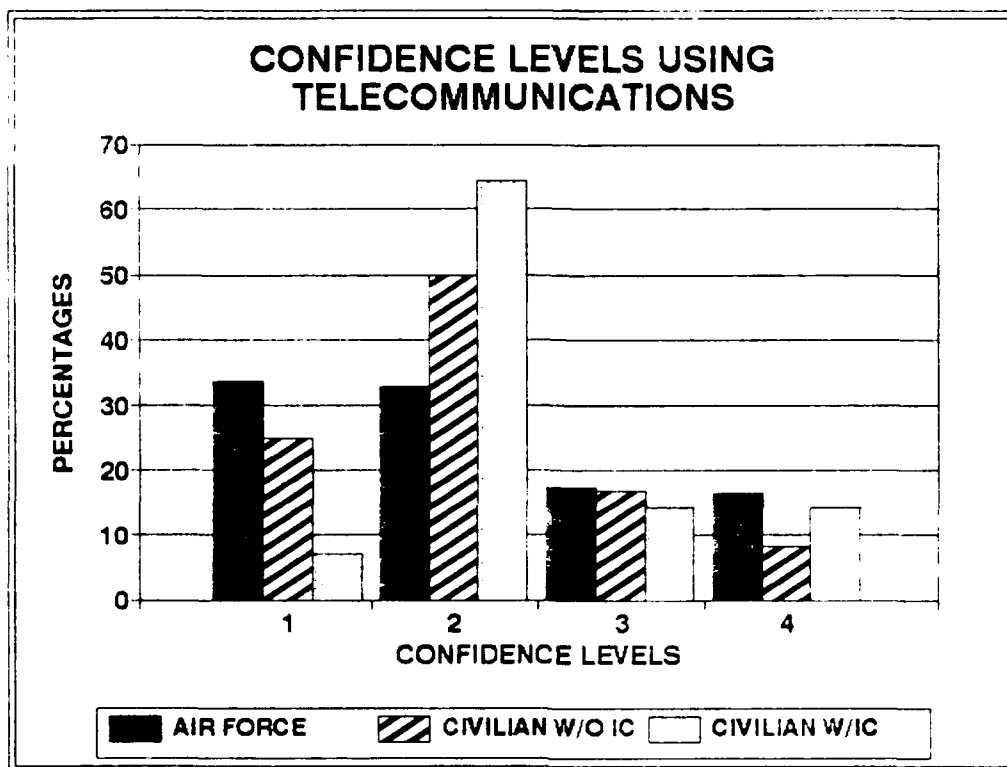


Figure 11. Relative Frequency Distribution of Confidence in Using Telecommunications for Each Sample

Hypothesis 1h. The types of applications used do not vary significantly among the samples.

Based on the analyses presented below, Hypothesis 1h is rejected.

Types of Applications Used. Chi square comparisons show that applications used by Air Force end users and end users in civilian organizations without information centers are not significantly different. There is also no significant difference between civilian organizations with and without information centers. However, between the Air Force and civilian organizations with information centers there is a significant difference. The percentage of end users in the civilian organizations with information centers who use spreadsheets is

greater than those in the Air Force, but Air Force end users are more likely to use telecommunications than end users in civilian organizations with information centers. Figure 12 gives the relative frequency distribution for all three samples.

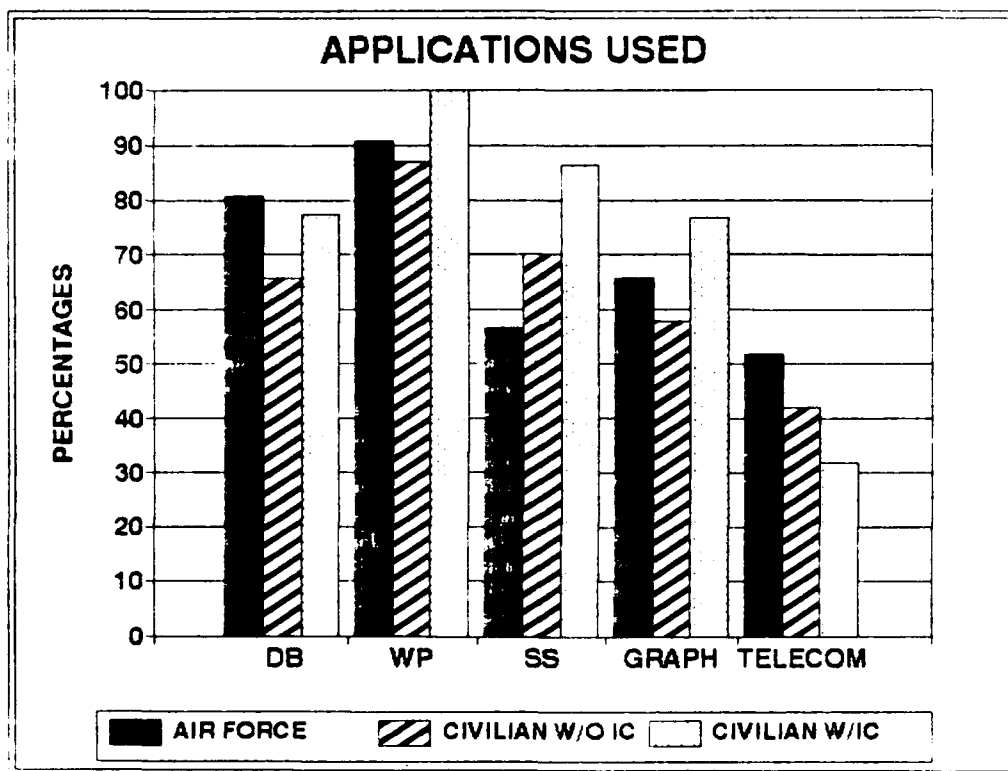


Figure 12. Relative Frequency Distribution of Computer Applications Used by End Users in Each Sample

Combinations of Applications. Table 8 gives the relative frequency distribution of all combinations of applications used by end users in the Air Force, in civilian organizations without information centers, and in civilian organizations with information centers. There does not seem to be a significant difference in the types of applications used among the three samples.

Table 8

Combinations of Applications Used by End Users in Each Sample

APPLICATIONS AND COMBINATIONS OF APPLICATIONS	RELATIVE FREQUENCY (RANK ORDER)		
	AIR FORCE	CIVILIAN WITHOUT IC	CIVILIAN WITH IC
DB, WP, SS, G, T	40.00 (1)	30.28 (1)	22.73 (2)
DB, WP	12.50 (2)	4.59 (6)	6.82 (3)
DB, WP, SS, G	10.00 (3)	7.34 (4)	38.64 (1)
DB, WP, G	6.25 (4)	.00----	2.27 (5)
DB, WP, T	4.17 (5)	2.75 (8)	.00----
DB, WP, SS	3.75 (6)	10.09 (3)	2.27 (5)
WP	2.92 (7)	3.67 (7)	.00----
WP, G	2.92 (7)	2.75 (8)	2.27 (5)
WP, G, T	2.92 (7)	1.83 (9)	.00----
DB, WP, G, T	2.92 (7)	.92(10)	.00----
DB	2.50 (8)	5.50 (5)	2.27 (5)
WP, SS, G	2.50 (8)	12.84 (2)	6.82 (3)
WP, T	1.67 (9)	1.83 (9)	.00----
DB, WP, SS, T	1.25(10)	2.75 (8)	4.55 (4)
DB, G	.83(11)	.00----	.00----
WP, SS, T	.83(11)	.00----	2.27 (5)
SS	.42(12)	1.83 (9)	.00----
T	.42(12)	.00----	.00----
DB, T	.42(12)	.92(10)	.00----
DB, G, T	.42(12)	.00----	.00----
SS, G, T	.42(12)	.00----	.00----
G	.00----	.92(10)	.00----
DB, SS	.00----	.92(10)	.00----
WP, SS	.00----	5.50 (5)	6.82 (3)
SS, G	.00----	.00----	.00----
SS, T	.00----	.00----	.00----
G, T	.00----	.00----	.00----
DB, SS, G	.00----	.92(10)	.00----
DB, SS, T	.00----	.00----	.00----
DB, SS, G, T	.00----	.00----	.00----
WP, SS, G, T	.00----	1.83 (9)	2.27 (5)

Hypothesis 1i. There is no significant difference among the samples regarding who uses the results of end user's computing.

Before making chi square comparisons, the first two categories, "No one," and "I don't know," were eliminated. Responses to these categories totaled less than one percent of all three samples combined.



The chi square comparisons between the Air Force and civilian organizations without information centers and between the two civilian samples indicated a significant difference. The results of the Air Force end user's computing is four times as likely to be used by his or her unit than in civilian organizations with information centers and twice as likely in civilian organizations without information centers. On the other hand, end users in civilian organizations with information centers are twice as likely to produce computing results for their boss than end users in civilian organizations without information centers and four times as likely as end users in the Air Force.

Hypothesis 1i is rejected.

Hypothesis 1j. End users in each of the three samples agree on the effect that using a computer has had with regard to the quality and quantity of their work.

There was no significant difference between any of the samples concerning an increase in the quality of work as a result of using a computer (Table 9).

The end users in the civilian sample with information centers felt they produced a significantly higher quantity of work as a result of using a computer. There was no significant difference between the Air Force sample and the civilian sample without information centers (Table 9).

Hypothesis 1j is rejected.

Hypothesis 1k. There is no significant difference in the levels of confidence end users in each of the three samples have in using a computer to meet the needs of their job.

The civilian sample with information centers noted a significantly higher level of confidence in meeting the needs of their job as a result of using a computer. No significant difference was noted between the Air Force and civilian organizations without information centers (Table 9).

Hypothesis 1k is rejected.

Hypothesis 1l. End users in each of the samples agree on the amount of increased productivity they would realize with stronger computer skills.

The Air Force sample felt their overall productivity would be significantly higher with stronger computer skills. No significant difference was noted in either civilian sample (Table 9).

Hypothesis 1l is rejected.

Table 9

Significant Differences Between Means for Confidence,  
Productivity, Quality, and Quantity

	p	df	AIR FORCE	CIV w/o IC	CIV w/ IC
*Confidence	.09	407			H
*Productivity	.00	368	H		
Quality	.09	392			
*Quantity	.01	373			H
<u>Statistical Test:</u> Ryan-Einot-Gabriel-Welsch F-test at alpha = .10; ANOVA test.					
* - Significant Difference    H - Higher Level    L - Lower Level					

Hypothesis 2. End users in each of the three samples have similar support needs.

A chi square comparison among the three samples indicates that there is no significant difference between the types of support needed by end users in the Air Force and civilian organizations without information centers. There is, however, significant differences in the types of support needed by end users in civilian organizations with information centers when compared to both end users in the Air Force and end users in civilian organizations without information centers.

Analysis of the portion of support needs that were not met for each sample showed that while the Air Force and civilian organizations without information centers had roughly the same proportion of needs that were not met, civilian organizations with information centers had nearly four times the percentage of unmet needs as the other two samples.

Table 10 gives the percentage of end users in each sample that required each specific type of support as well as the portion of support needed that was not met.

Table 10

Percentage of End User Support Needed  
and Percentage of Needed Support Not Met

SUPPORT	AIR FORCE		CIVILIAN WITHOUT INFORMATION CENTER		CIVILIAN WITH INFORMATION CENTERS	
	A	B	A	B	A	B
Advising	48	7	61	9	100	37
Backup	41	6	60	6	63	30
Compatibility	38	7	52	10	61	31
Development	41	8	61	10	67	34
Documentation	53	11	56	10	65	29
Hotline/Debugging	26	12	46	12	44	26
Listing of Resources	26	11	23	12	9	25
Maintenance	55	6	64	7	56	21
Data Transfer	39	9	39	14	44	32
Newsletter	35	16	38	23	49	24
Purchase Assistance	16	10	19	0	49	38
Recovery	31	15	35	0	40	35
Product Research	18	15	22	4	9	9
Training	45	6	46	4	65	36

A = Percentage of sample needing that specific support.  
B = Percentage of A that was not met.

Hypothesis 3. There is no significant difference in the importance end users in each sample place on each type of support.

An ANOVA test and a REGWF test were applied to each of the 14 different types of support. The data tables are located in Appendix F.

End users in civilian organizations with information centers felt Advise, Hotline/Debugging, and Purchase Assistance support were significantly more important than end users in the Air Force or in organizations without information centers (Table 11).

End users in civilian organizations without information centers felt Newsletter support was significantly less important than Air Force

end users or end users in civilian organizations with information centers (Table 11).

Air Force end users felt Development support was significantly less important than the two civilian samples (Table 11).

No significant difference in the level of importance was noted by any sample for Backup, Compatibility, Documentation, Listing of Resources, Maintenance, Data Transfer, Recovery, Product Research, or Training support (Table 11).

Table 11

Significant Differences Between Means for Importance  
of Each Type of End User Support

SUPPORT	p	df	AIR FORCE	CIV w/o IC	CIV w/ IC
*Advise	.01	367			H
Backup	.67	369			
Compatibility	.06	373			
*Development	.02	363	L		
Documentation	.86	369			
*Hotline/Debug	.04	358			H
List Resource	.33	352			
Maintenance	.61	373			
Data Transfer	.15	358			
*Newsletter	.00	362		L	
*Purchase Assist	.02	351			H
Recovery	.19	360			
Research Product	.10	347			
Training	.32	370			
<u>Statistical Test:</u> Ryan-Einot-Gabriel-Welsch F-test at alpha = .10; ANOVA test.					
* - Significant Difference    H - More Important    L - Less Important					

Each type of support was rank ordered from the highest to the lowest mean and sorted by sample (Table 12). Training, Maintenance, and

Recovery were the three types of support perceived as most important by the three samples. Listing of Resources and Newsletter were identified by all samples as the four least important types of support.

Table 12

Rank Order Comparison of the Importance of Each Type of Support for Each Sample

TYPE OF SUPPORT	AIR FORCE	CIV w/o IC	CIV w/ IC
Advise	10	9	6
Backup	6	7	9
Compatibility	5	5	4
Development	8	6	7
Documentation	4	4	8
Hotline/Debugging	9	8	5
List Resource	12	12	14
Maintenance	2	1	2
Data Transfer	7	11	11
Newsletter	11	14	13
Purchase Assistance	13	13	10
Recovery	3	2	3
Research Products	14	10	12
Training	1	3	1

Hypothesis 3 is rejected.

Hypothesis 4. There is no significant difference between end users in each sample in their choice of the source of support.

Chi square analyses of the source of support chosen by end users in each sample and for each type of support showed there is a significant difference in choice among end users in the three samples.

Table 13 lists the percentage of end users in each sample who chose a specific source of support for each type of support they required. Appendix D compares the relative frequency distribution of

sources of support selected by end users in each sample for each type of support.

Hypothesis 4 is rejected.

Table 13  
Percentage Comparison of Sources of  
Support Selected by End Users for Each Type of Support

SUPPORT	COMP USER SUPPORT OFFICE A--B--C	INFOR- MATION CENTER A--B--C	CO- WORKER A--B--C	FRIEND A-B-C	VENDOR/ CONSUL- TANT A--B--C	OTHER A--B--C
Advising	32-38-15	7-10-62	44-36-15	5-0-4	8-11- 4	5-5- 0
Backup	36-39-22	6- 6-44	36-35-68	7-2-0	8-11-17	6-6- 0
Compatibility	42-43-12	8-12-47	27-22- 6	5-0-6	11-18-24	7-6- 6
Development	26-46-11	9-11-56	43-25- 6	6-0-0	9-13-22	6-5- 6
Documentation	25-31-10	13-11-40	33-22-10	6-0-0	17-28-40	8-7- 0
Hotline	47-39-21	14-14-36	9- 7- 0	3-0-0	17-36-43	10-5- 0
List Resources	41-39- 0	12-13-33	38-43-67	2-0-0	5- 4- 0	2-0- 0
Maintenance	43-58-22	7- 8-28	12- 9- 6	2-0-0	3-20-44	4-5- 0
Data Transfer	45-32-17	11-16-50	31-35-33	4-5-0	5- 5- 0	6-5- 0
Newsletter	35-33-19	20-30-31	20-18- 6	3-0-0	18-18-38	4-0- 6
Purchase Asst	52-57- 0	12- 0-62	18-19- 8	3-5-0	6-19-23	9-0- 8
Recovery	47-67-18	18- 0-55	24-23-27	2-0-0	3-10- 0	6-0- 0
Prod Research	21-35- 0	21- 4- 0	18-30-25	3-0-0	24-30-50	15-0-25
Training	27-27-24	7- 4-59	56-41- 0	2-4-0	1-18-12	8-6- 6

A = Air Force

B = Civilian Organizations Without Information Centers

C = Civilian Organizations With Information Centers

Due to rounding, percentages in each sample and for each type of support may not equal 100 percent.

Table 14

Preferred Source of Support by Type of Support for Each Sample

SUPPORT	PREFERRED SOURCE		
	A	B	C
Advise	3	1,3	2
Backup	3	1	2
Compatibility	1	1	2
Development	3	1	2
Documentation	3	1	2,4
Hotline/Debug	1	1	5
List Resource	1	3	3
Maintenance	1	1	5
Data Transfer	1	3	2
Newsletter	1	1	5
Purchase Assist	1	1	2
Recovery	1	1	2
Research Product	5	1	5
Training	3	3	2
A = Air Force      1 - Computer User Support Office (CUSO) B = Civ w/o IC      2 - Information Center (IC) C = Civ w/ IC      3 - Co-Worker 4 - Friend Outside of Work 5 - Vender/Consultant			

Hypothesis 5. End users in each sample are equally satisfied with the support they receive from each source of support for each type of support.

An ANOVA test and a REGWF test were applied to each of the 14 types of support. The mean and standard deviation data for each sample and for each type of support are located in Appendix F.

End users in civilian organizations with information centers felt a significantly higher level of satisfaction with Purchase Assistance and Training support (Table 15).



End users in civilian organizations without information centers felt a significantly lower level of satisfaction with Data Transfer support (Table 15).

No significant difference was noted in the level of satisfaction for Advise, Backup, Compatibility, Development, Documentation, Hotline/Debugging, Listing of Resources, Maintenance, Newsletter, Recovery, and Product Research support (Table 15).

Table 15  
Significant Differences in Satisfaction Between  
End Users in Each Sample

SUPPORT	p	df	AIR FORCE	CIV w/o IC	CIV w/ IC
Advise	.27	200			
Backup	.04	130			
Compatibility	.96	162			
Development	.60	174			
Documentation	.41	195			
Hotline/Debug	.91	120			
List Resource	.17	85			
Maintenance	.55	215			
*Data Transfer	.01	136		L	
Newsletter	.48	119			
*Purchase Assist	.03	67			H
Recovery	.76	117			
Research Product	.20	59			
*Training	.02	175			H
Statistical Test: Ryan-Einot-Gabriel-Welsch F-test at alpha = .10					
* - Significant Difference      H - More Satisfied    L - Less Satisfied					

Each type of support was rank ordered from the highest to the lowest mean and sorted by sample (Table 16). There was no commonality of satisfaction across the three samples for any type of support. Listing of Resources appeared to be located somewhere in the bottom four

types of support, indicating less overall satisfaction. It did not show a significant difference in means between the samples.

Compared to the Air Force and civilian organizations without information centers, the rank order for civilian organizations with information centers was much lower for Maintenance and Recovery support and appeared higher for Purchase Assistance.

Compared to the Air Force and civilian organizations with information centers, the rank order for civilian organizations without information centers was much higher for Compatibility and much lower for Data Transfer support.

Table 16

Rank Order Comparison of Satisfaction for Each Type of Support

TYPE OF SUPPORT	AIR FORCE	CIV w/o IC	CIV w/ IC
Advise	6	5	3
Backup	1	6	6
Compatibility	13	3	10
Development	8	7	5
Documentation	12	10	9
Hotline/Debugging	9	4	8
List Resource	11	12	14
Maintenance	5	2	12
Data Transfer	3	11	2
Newsletter	7	8	7
Purchase Assistance	14	14	4
Recovery	2	1	11
Research Products	10	13	13
Training	4	9	1

Five sources of support were identified: Computer User Support Office (CUSO), Information Center, Co-worker, Friend Outside of Work, and Vender/Consultant. Insufficient data points in at least one sample

precluded a REGWF test to compare the means. However, the means and standard deviations, located in Appendix F, compare end user satisfaction with support from a particular source. Each of the five sources of support were examined.

Table 17 rank orders end user satisfaction with each type of support provided by each source of support.

Computer User Support Office. Recovery was ranked in the top two types of support provided by a CUSO by all three samples. The Air Force identified Recovery as the number one type of support provided by a CUSO. Civilian organizations without information centers ranked Recovery as second. Recovery was tied with Data Transfer in civilian organizations with information centers. The latter sample did not have responses for all types of support. Purchase Assistance provided by the CUSO was rated lowest (Table 17).

Information Center. The Air Force sample and one of the civilian samples did not have information centers, yet many responses from these samples indicated support was received from an information center. Civilian organizations with information centers identified Training as having the highest level of satisfaction (Table 17).

Co-worker. Compatibility appeared to rank in the top three types of support for all samples. Purchase Assistance was ranked lowest by all three samples (Table 17).

Friend Outside of Work. The Air Force received all types of support from this source, whereas the two civilian samples received very limited types of support from friends outside of work (Table 17).

Vender/Consultant. A clear pattern is difficult to distinguish when examining all three samples, however, when considering

only Air Force and civilian organizations without information centers, Recovery had the highest satisfaction and Purchase Assistance had the lowest satisfaction (Table 17).

Table 17

Comparison of Means for Satisfaction with  
Computer User Support Office, Information Center, Co-Worker,  
Friend Outside of Work, and Vender/Consultant

SUPPORT	CUSO			IC			CO-WORKER		
	A	B	C	A	B	C	A	B	C
Advise	4	4	7	14	5	4	8	7	1*
Backup	9	3	6	2	7	5*	4	4	7
Compatibility	11	7	8*	12	1	11	2	3	4*
Development	12	8	9*	5	3	3	1	8	8*
Documentation	5	11	11	7	10	7	1	12	3*
Hotline/Debug	3	6	10	1	2	10	13	9	-
List Resource	6	10	-	13	12	8	10	6	11
Maintenance	7	1	3*	8	4	13	5	14	2*
Data Transfer	2	12	2*	10	8	2	9	11	6
Newsletter	13	9	5	9	9	9	7	2	9*
Purchase Asst	14	14	-	4	-	6*	14	13	10
Recovery	1	2	1*	11	-	12	11	1	5
Research Prod	8	13	-	3	6	-	12	10	-
Training	10	5	4*	6	11	1	6	5	-

A = Air Force    B = Civilian Without IC    C = Civilian With IC

\* Represents a tie score within that sample

Table 17 (continued)

Comparison of Means for Satisfaction with  
Computer User Support Office, Information Center, Co-Worker,  
Friend Outside of Work, and Vender/Consultant

SUPPORT	FRIEND OUTSIDE WORK			VENDER/CONSULTANT		
	A	B	C	A	B	C
Advise	3	1*	2	12	7	1
Backup	2	2*	-	2	13	6*
Compatibility	14	-	1	10	6	11
Development	13	-	-	4	4	7*
Documentation	12	-	-	11	3	10
Hotline/Debug	11	-	-	5	10	4
List Resource	5*	-	-	7	-	-
Maintenance	1	-	-	9	5	5
Data Transfer	4	3*	-	8	2	-
Newsletter	10	-	-	3	9	2
Purchase Asst	6*	-	-	13*	12	3
Recovery	7*	-	-	1	1	-
Research Prod	8*	-	-	6	8	8*
Training	9*	4	-	14*	11	9*

A = Air Force    B = Civilian Without IC    C = Civilian With IC

\* Represents a tie score within that sample

Other. Survey respondents were given the opportunity to write in additional sources of support. Those responses may be found in summary form in Appendix C.

Civilian organizations with an information center identified the information center as their preferred source of support nine times. Civilian organizations without an information center identified computer user support office as their preferred source of support 11 times. The Air Force identified computer user support office as their preferred source of support eight times. Generally speaking, the computer user support office and the information center were preferred over other types of support. Table 18 lists the source of support with the highest

average rating for satisfaction for each type of support and for each sample.

Hypothesis 5 is rejected.

Table 18

Sources of Support With the Highest Satisfaction Rating  
for Each Type of Support and for Each Sample

SUPPORT	AIR FORCE	CIVILIAN WITHOUT INFORMATION CENTER	CIVILIAN WITH INFORMATION CENTER
Advise	4	2	5
Backup	4	3	1/2
Compatibility	3	2	1,2/3/4
Development	3	5	2
Documentation	3	5	2
Hotline/Debugging	2	2	5
Listing of Resources	1	3	2
Maintenance	4	2	1
Data Transfer	1	5	1
Newsletter	5	3	5
Purchase Assistance	2	3/5	5
Recovery	5	5	1
Product Research	1	2/3/5	5
Training	1	3	1/2

1 = Computer User Support Office  
2 = Information Center  
3 = Co-worker  
4 = Friend Outside of Work  
5 = Vender/Consultant

Hypothesis 6. An information center is the best source of support for meeting the needs of end users.

All reported support was sorted by the source of support. Then, for each instance of support, that user's evaluation of satisfaction with the support received was weighted by the user's evaluation of the importance of that type of support. The average for each source of

support was used to rank order the sources of support. Figure 13 shows the results of this analysis.

Hypothesis 6 is rejected.

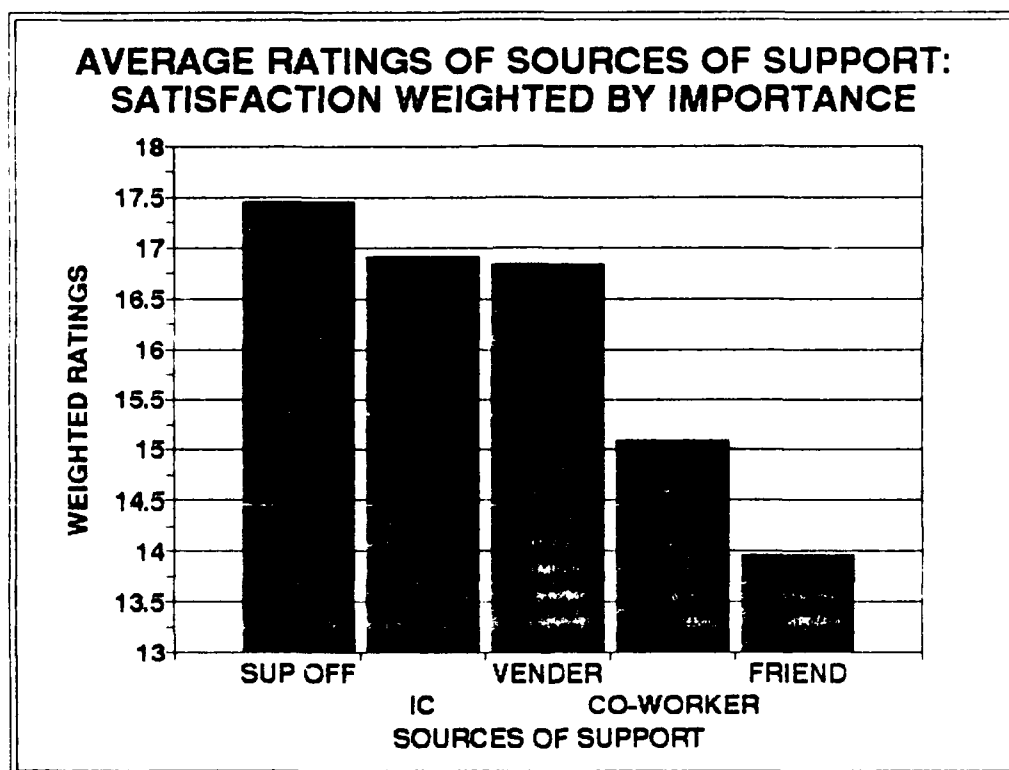


Figure 13. Average Rating of Sources of Support  
for Satisfaction Weighted by Importance

### Summary

In this chapter the survey response rates were presented. The survey responses from all three samples were analyzed in terms of the research hypotheses and in accordance with the analysis plan outlined in Chapter 3.

## V. Conclusions and Recommendations

### Introduction

This chapter summarizes the findings that resulted from the data analyses presented in Chapter IV. From these findings, conclusions are presented along with specific recommendations for action and further research.

### Summary of Findings

The following findings are a direct result of the analysis of 416 survey responses.

Finding 1. Air Force end users are significantly different from their civilian counterparts. The Air Force end user is more likely to be a man under the age of 40. He will have at least a high school education with some additional college courses. He will be employed at the operational level of the organization, either performing the basic work of the unit or functioning as a first-line supervisor. Generally, he has fewer years of experience as an end user and is much less likely to have had any formal computer education.

It is much more difficult to describe civilian end users. They are as likely to be male as to be female. The age distribution appears more bell shaped over the range of age categories. The civilian end user is also more likely to be better educated. They are also more likely to occupy a middle management or specialist position in the organizational structure than an Air Force end user. They have also probably used a computer longer and received more formal computer education.



Finding 2. There is little difference among end users in the types of applications used or in the confidence end users have in their ability to use those applications. There are two exceptions to this finding. First, end users in civilian organizations are more likely to use spreadsheets than Air Force end users. Second, Air Force end users are more likely to use telecommunications than end users in civilian organizations with information centers.

Finding 3. There is a significant difference among the samples in response to who uses the results of the end user's computing. Five percent of Air Force end users said that either no one used the results or that they didn't know who used the results. Nearly half of the results were used by the user's unit with only a quarter of the results being used by other units.

The civilian end user in both samples is almost as likely to produce results for himself, his boss, his unit, and other units.

Finding 4. There were significant differences among the three samples with regard to the impact of computing on the end user's job performance. In all three samples, end users responded that as a result of using a computer the quality of their work had much improved and the quantity was much increased. Although end users in all three samples expressed high confidence in their ability to use a computer to meet the needs of their job, civilian end users felt that with stronger computer skills, they could be a little more productive. On the other hand, Air Force end users felt their overall productivity could be increased much more than the civilian end users if they improved their computer skills. End users in civilian organizations with information centers expressed more confidence in using a computer to meet the needs of their job than

end users in the other two samples. They also indicated that using a computer had increased the quantity of the work they produced significantly more than the increase indicated by end users in the other two samples.

Finding 5. There were no significant differences in the support needs of end users among the three samples. However, end users in civilian organizations with information centers reported three times as many unmet support needs as did end users in the other two samples.

Finding 6. End users in each of the three samples ranked Training, Maintenance, and Recovery as the three most important types of support. End users in civilian organizations with information centers, however, placed significantly more importance on Advising, Hotline/Debugging, and Purchase Assistance than end users in the other two samples. Air Force end users placed significantly less importance on Development, and end users in civilian organizations without information centers placed significantly less importance on Newsletters. Other than these five differences, all end users agreed on the importance of the remaining types of support.

Finding 7. Since two of the samples do not have an organizational unit identified as an information center, it is not surprising to see significant differences among the samples in the source of support chosen by end users. Even by combining the responses to information center and computer user support office, there are still significant differences among the samples. Generally, end users in civilian organizations without information centers are more likely than Air Force end users to go to a computer user support office or information center for support, and end users in civilian organizations with information

centers are more likely than both of the other two samples. Air Force end users and end users in civilian organizations without information centers are more likely than end users in civilian organizations with information centers to seek help from co-workers. Air Force end users sometimes seek help from friends while end users in the two civilian samples almost never do. And finally, Air Force end users are the least likely to call on a vender or consultant for assistance while end users in civilian organizations with information centers are the most likely.

In all cases except the following, the primary choice for support in all three samples is the computer user support office or information center. For Advising, Development, and Training, the Air Force end user's first choice is a co-worker. End users in civilian organizations without information centers also choose a co-worker first for Training. End users in civilian organizations with information centers choose a co-worker first for Listing of Resources and a vender or consultant for Product Research.

Finding 8. Computer user support offices and information centers provided the best support to end users, followed closely by vendors or consultants.

#### Value.

Discussion. It is interesting to note that the product of end-user computing in the Air Force is more likely to be used by someone in the unit versus a supervisor or other work units. Additionally, four times as many Air Force end users felt no one was using their computing products. Combined with the fact that Air Force end users feel increased computer skills would also increase their productivity, it

appears end users may be generating computer products which add no real value to the organization. Short-term appraisal systems may influence the need to generate reports simply to show productivity on the part of the end user. Civilian organizations with an information center were more confident and felt the increased quantity of work produced was used to a much larger degree by their supervisors. Zero percent felt their product was used by no one, suggesting everyone felt their product was useful. They were generating a product which added value to the organization. Since all products were perceived as useful, efficiency in managing information seems better in civilian organizations with an information center versus the Air Force. The organization appears to have communicated a clearer picture of its strategic plan to end users who, in turn, generate products which add value to the organization. End users understand the overall mission of their organization and try to improve it. The profit motive may be the distinguishing factor between these two samples. End users are rewarded for increased profits within civilian organizations. The Air Force, on the other hand, appears not to have communicated its goals or strategic plan to end users as effectively. Consequently, end users work in their own small work center generating many products with very limited value. Inefficiency appears to be present in information management due to lack of vision and strategic planning.

Conclusion. End users in civilian organizations with an information center generate more useful products which add value to the organization. The organization manages its information resources more efficiently, resulting in more confident, more satisfied, and more productive end users.

Recommendations. A field study of Air Force and civilian organizations should be conducted to determine the types of information products generated and why they are produced. Additionally, further research is required to determine how senior management communicates its strategic plan to end users in civilian organizations with information centers versus the Air Force.

### Adaptability

Discussion. The initial mission of information centers was to help reduce the information systems development backlog. Later, the information center was responsible for introducing the personal computer to end users in the organization. The end user was able to learn the basic operation of the computer and focus on its application to their specific job. Their knowledge level gradually increased with the help of the information center. With the proliferation of personal computers through the 1980s and 1990s, end users were introduced to them at a much earlier age, probably in grade school. Subsequently, part of the information center's mission disappeared because end users were already at a basic operational level when they arrived at the organization. When Fourth Generation Languages were developed, end users began developing many of their own applications for their work centers. Unfortunately, the information center did not keep pace with the requirements of the end user. It appears that end users in civilian organizations with information centers were more satisfied with the support they received in the past, but developed an even greater need for more advanced support. End users are maturing and require more support than basic operational training. The more the end user knows

about computing, the more they want to learn. They have already demonstrated a more integrated use of applications versus the entry level use of computer applications in the Air Force and civilian organizations without information centers. The information center acted as a catalyst to motivate end users in the quest for advanced computer knowledge. Unfortunately, information center planners failed to identify their mission after their initial successes. Perhaps their mission statement was too focused.

Civilian organizations with information centers in the Dayton, Ohio area belonged to an Information Center Support Group as recently as 1988. However, many information centers were cut from the organizations and the Information Center Support Group disappeared. The reduction in information centers in the Dayton area may be related to their failure to adapt to advanced end users.

Conclusion. Information centers were initially successful for entry level requirements, but failed to evolve with the maturing end user. The information center focused on basic operational and hardware issues rather than the advanced applications end users required. When the end users' need for the information center began decreasing, the information center lost its influence and leadership position. Some organizations began discontinuing the information center. Its failure to innovate and meet the needs of its advanced users diminished its value to the organization.

Recommendations. Further research is required to develop a method to measure changes in the abilities and needs of the end user, allowing information centers to adapt to advanced users and remain flexible in their support. Further research is also required to determine why the

number of information centers in the Dayton, Ohio area is significantly less than three years ago.

### Brokerage

Discussion. While computer user support offices and information centers were determined to provide the best support to end users, the vender/consultant category also received high marks. This latter category was not chosen by Air Force end users as often as by end users in both of the civilian samples. Nonetheless, it received high ratings from those end users who availed themselves of this source of support.

Conclusion. The Air Force may not be taking full advantage of the support available from vendors or consultants.

Recommendations. A cost/benefit analysis should be conducted to determine if contracting with a broker who provides end user support would be a more effective and efficient method of providing for end user support for all or selected support needs.

### Stratification

Discussion. Even though the Air Force end user is not as educated, does not have as much experience computing, and has not received as much formal computer training as end users in the civilian samples, there is no significant difference among end users in the support required. This seems to be counterintuitive. One could reasonably expect someone with less experience, education, and training to require more support, but based on the research this is not the case.

Even though over 90 percent of Air Force end users occupy positions at the operational levels of the organization compared to a nearly even distribution across the range of organizational levels for

civilian end users, there is very little difference among end users in the applications used. This too appears counterintuitive.

A closer examination of the combinations of applications used provided some insight into a possible explanation of these two apparent inconsistencies. This explanation implies a further stratification of end users based on the specific tasks they perform, a new model of application combinations, and a stratification of support levels for each type of support.

#### Conclusions.

(1). Basic demographics (sex, age, education, experience, and training) are either not sufficient or of no significance in determining the needs of end users.

(2) The end user's placement in the organizational structure is not sufficient to predict the support needs of end users.

Recommendations. A field study of selected Air Force bases is recommended to determine what tasks end users are performing (or should be performing) at the various levels of the organization. Appropriate applications should then be matched to these tasks.

Figure 14 is offered as a test model for balancing the percentage of end users required in each category to perform the tasks identified by the field study.

The field study should identify not only the tasks to be performed and the applications or combinations of applications most appropriate to the tasks, but also the required level of confidence or competence using the applications. The end user support function could therefore tailor its support efforts to meet the needs of its end-user clientele more closely.



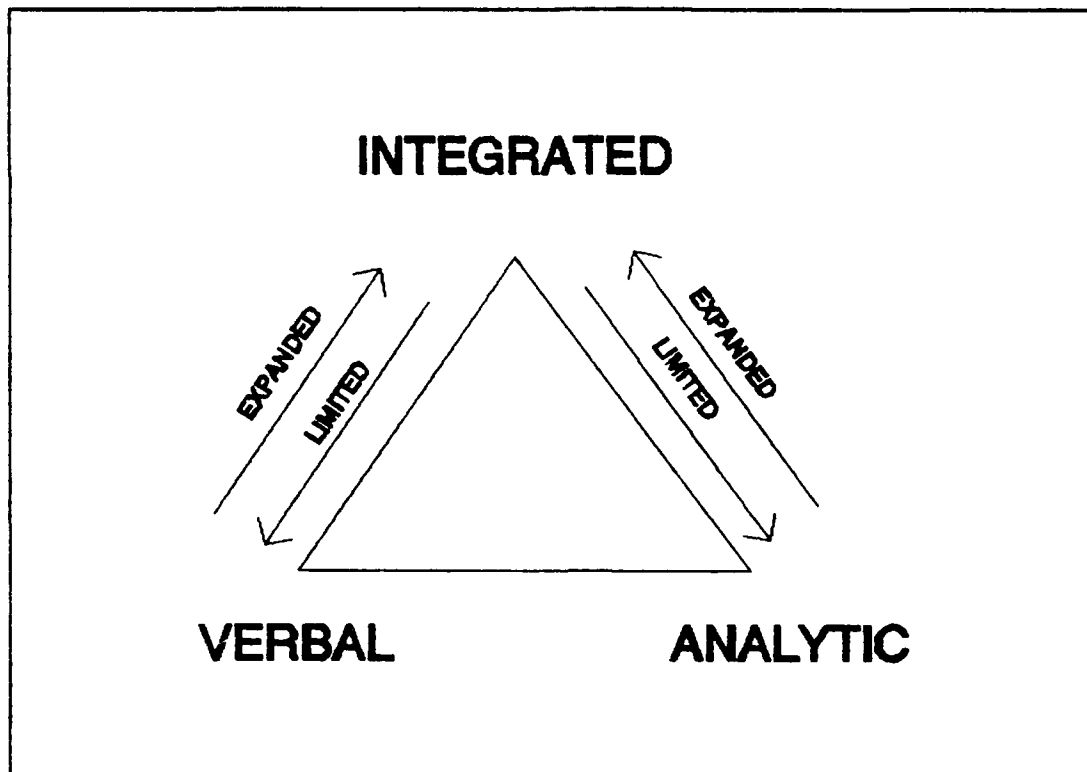


Figure 14. Test Model of Applications and Combinations of Applications for End User Categorization

Table 19 shows the combinations of applications that were grouped into five categories. The five categories are defined below.

Limited Verbal. These applications and combinations of applications are used to produce letters and reports.

Limited Analytic. These applications and combinations of applications are used to analyze numeric information and produce reports.

Expanded Verbal. These applications and combinations of applications expand the user's capabilities through access to databases. For example, with only limited verbal applications, the user can produce a letter for a specific client. With expanded verbal applications, the user can query a database to determine which clients should receive the

letter, and, using mail merge, produce personalized letters to each client.

Expanded Analytic. These applications and combinations of applications also expand the user's capabilities through access to databases. For example, with only limited analytic applications, the user can enter data into a spreadsheet and project expected work loads over the next six months. With expanded analytic applications, the user can design a decision support system to calculate the expected work load of several work centers by importing historical data from existing databases.

Integrated. These combinations of applications allow the user to access required information from one or more databases and either import the data into a spreadsheet for analysis, or into a word processing document to produce a report, or both. This category includes databases, word processors, and spreadsheets, at a minimum.

Figure 15 shows the relative frequency distribution comparison for all three samples. Significantly more end users in civilian organizations with information centers fell into the integrated category than end users in the other two samples. Also, end users in civilian organizations were four to five times more likely to fall into one of the analytic categories than Air Force end users.

Table 19

## Categorical Combinations of Applications

LIMITED VERBAL	LIMITED ANALYTIC
Word processor	Spreadsheet
Word processor, graphics	Spreadsheet, graphics
Word processor, telecommunications	Spreadsheet, telecommunications
Word processor, graphics, telecommunications	Spreadsheet, graphics, telecommunications
Database	Word processor, spreadsheet
Database, telecommunications	Word processor, spreadsheet, graphics
Telecommunications	Word processor, spreadsheet, telecommunications
	Graphics
	Graphics, telecommunications
EXPANDED VERBAL	EXPANDED ANALYTIC
Database, word processor	Database, spreadsheet
Database, word processor, graphics	Database, spreadsheet, graphics
Database, word processor, telecommunications	Database, spreadsheet, telecommunications
Database, word processor, graphics, telecommunications	Database, spreadsheet, graphics, telecommunications
	Database, graphics
	Database, graphics telecommunications
INTEGRATED	
Database, word processor, spreadsheet, graphics, telecommunications	
Database, word processor, spreadsheet, graphics	
Database, word processor, spreadsheet, telecommunications	
Database, word processor, spreadsheet	

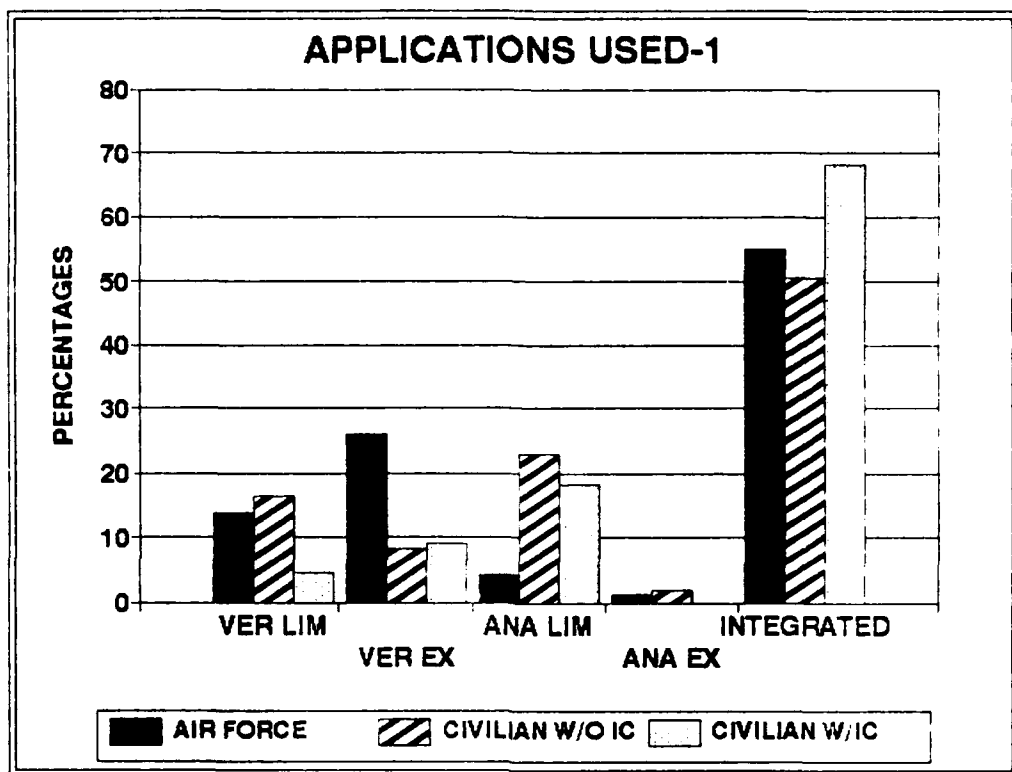


Figure 15. Relative Frequency Distribution of Application Group One: Verbal Limited, Analytic Limited, Verbal Expanded, Analytic Expanded, and Integrated

By combining the limited and expanded verbal categories into a single category, verbal, and by combining the limited and expanded analytic categories into a single category, analytic, Figure 16 shows the relative frequency distribution for each sample that fell into the three new categories, verbal, analytic, and integrated. Chi square analysis showed significant differences between Air Force and civilian end users. Air Force end users were more likely to fall into the verbal category than end users in civilian organizations which were more evenly distributed between the verbal and analytic categories.

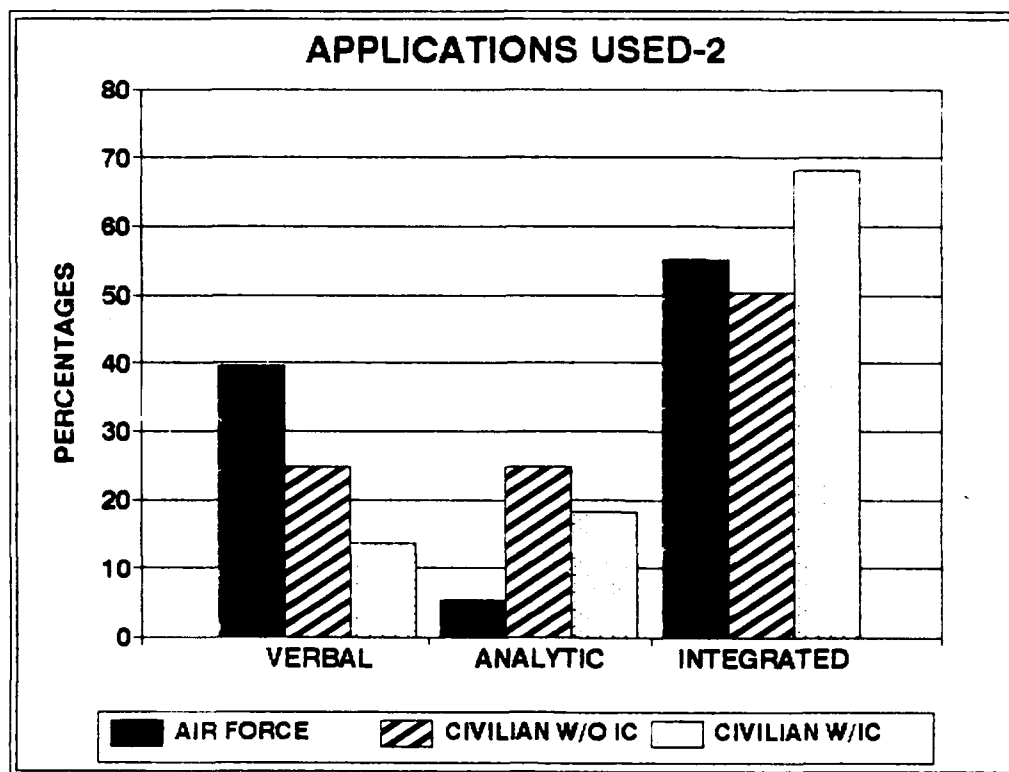


Figure 16. Relative Frequency Distribution of Application Group Two: Verbal, Analytic, and Integrated

By combining expanded verbal and expanded analytic into a single category, expanded, and by combining limited verbal and limited analytic into a single category, limited, Figure 17 presents the relative frequency distribution of each of the three new categories, expanded, limited, and integrated. The chi square analysis showed a significant difference between Air Force end users and civilian end users. Air Force end users were more likely to fall into the expanded category than end users in civilian organizations.

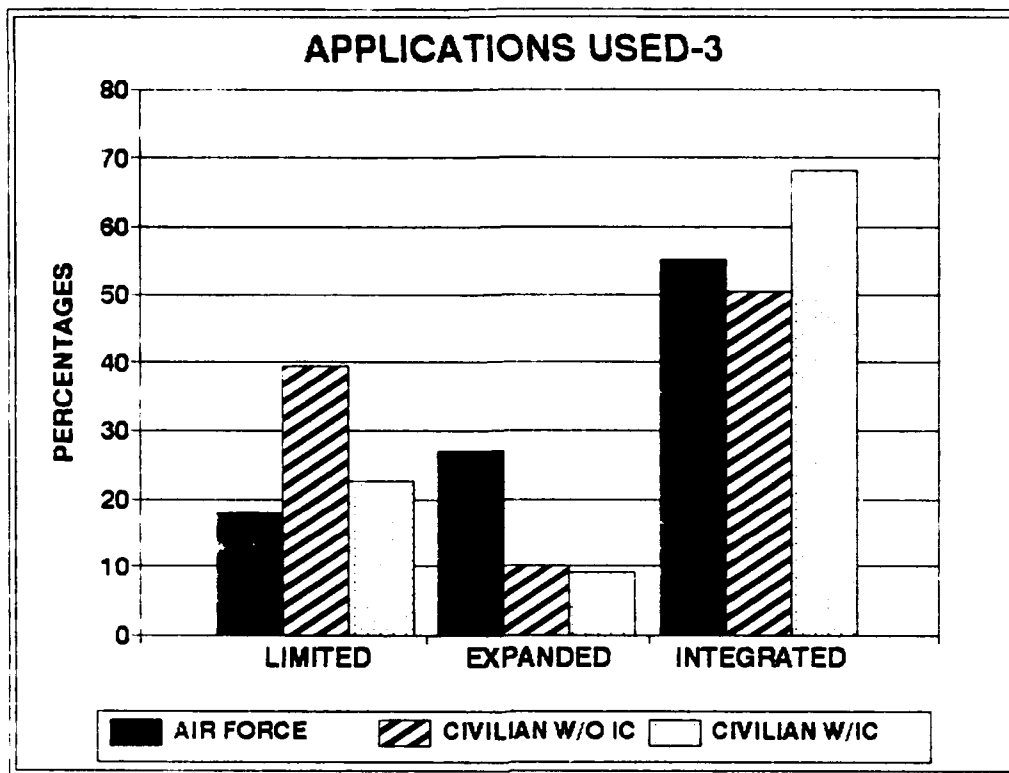


Figure 17. Relative Frequency Distribution Application  
Group Three: Expanded, Limited, and Integrated

#### Research Objective and Response

Research Objective. The purpose of the study was to determine whether or not an information center is an appropriate means of providing support to end users in the Air Force.

Response. Based upon the research, an information center is an appropriate means of providing support to end users in the Air Force.

#### Summary

This chapter summarized eight significant findings from the research study. Further, four conclusions applicable to Air Force end users, end-user support, and end-user management were presented along

with recommendations. And finally, the response to the research objective as determined from the results of the study were presented. This study, while answering the original research question, has raised several new questions. Future research to address these new questions should provide needed guidance to Air Force information resource managers.

## Appendix A: Survey Instrument

### Part 1.

ON YOUR COMPUTER ANSWER SHEET, IGNORE "D" AND "NA". FOR QUESTIONS 001 THROUGH 020, USE ONLY ANSWERS "1" THROUGH "7".

001. Indicate your sex.

1. Male.
2. Female.

002. Find the number below that includes your age.

1. 25 or less.
2. 26 to 32.
3. 33 to 39.
4. 40 to 46.
5. 47 to 53.
6. 54 to 60.
7. 61 or more.

003. Indicate the highest level of education you have achieved.

1. Less than a high school diploma.
2. High school diploma or graduate equivalent diploma.
3. Some courses beyond high school but no degree awarded.
4. Associate Degree, technical or trade school certificate.
5. Bachelor Degree.
6. Master Degree or higher.

004. Select the statement below that best describes you in your work environment.

1. I perform the basic work related directly to the production of my organization's products or services. (ex. purchasing agents, machine operators, assemblers, salespersons, shippers)
2. I directly supervise those who perform the basic work of production. (ex. foremen, production supervisors, shop chiefs)
3. I manage the supervisors who supervise those who perform the basic work of production. (ex. plant managers, squadron commanders, regional sales managers)
4. I serve to bring about standardization in the organization through scientific methods. (ex. strategic planner, operations researcher, financial analyst, management engineer)
5. I am a specialist, providing support to the organization outside the operating work flow. (ex. legal counsel, public relations, industrial relations, research and development, payroll)
6. I am at the top of the organization, charged with ensuring that the organization serves its mission in an effective way. (ex. chief executive officer, wing commander, vice president of operations)



**005.** How long have you used a computer on or off the job?

1. Less than 1 1/2 years.
2. 1 1/2 to 3 years.
3. 3 to 5 years.
4. 5 to 10 years.
5. 10 years or more.

**006.** Indicate the highest level of computer training you have completed.

1. None.
2. High school course(s).
3. Adult, continuing education, or college course(s).
4. Associate Degree in Computer Science, Information Resource Management, or Management Information Systems.
5. Bachelor Degree in Computer Science, Information Resource Management, or Management Information Systems.
6. Master Degree or higher in Computer Science, Information Resource Management, or Management Information Systems.
7. Other (fill in on this form)\_\_\_\_\_

For Questions 007 through 016, rate how confident you feel using that application. Use the following scale for each question.

1. Don't use it at all.
2. Don't recognize this.
3. I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
4. I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
5. I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
6. I can perform all of the functions of the application; others seek my help in using the application.

**007.** Databases.

**008.** Word Processing.

**009.** Spreadsheets.

**010.** Graphics.

**011.** Telecommunications.

For the next five questions, specify and rate your confidence with other applications you use, such as CAD, CAM, simulations, engineering, scientific, program or project management. If you do not have other applications to include for Questions 012 through 016, fill in "1" on your computer answer sheet.

012. Other. Please specify \_\_\_\_\_

013. Other. Please specify \_\_\_\_\_

014. Other. Please specify \_\_\_\_\_

015. Other. Please specify \_\_\_\_\_

016. Other. Please specify \_\_\_\_\_

017. Who uses the results of your computing most often?

1. No one.
2. I don't know.
3. I do.
4. My immediate supervisor.
5. My work unit.
6. Other work units.
7. Other. Please specify \_\_\_\_\_

018. Has using a computer improved the QUALITY of your work?

1. No.
2. I don't know.
3. Yes, VERY LITTLE improvement.
4. Yes, LITTLE improvement.
5. Yes, MODERATE improvement.
6. Yes, MUCH improvement.
7. Yes, VERY MUCH improvement.

019. Would your supervisor agree with your answer to Question 018?

1. My supervisor wouldn't know.
2. Yes.
3. No.

020. Has using a computer increased the QUANTITY of your work output?

1. No.
2. I don't know.
3. Yes, VERY LITTLE increase.
4. Yes, LITTLE increase.
5. Yes, MODERATE increase.
6. Yes, MUCH increase.
7. Yes, VERY MUCH increase.

**021.** Would your supervisor agree with your answer to Question 020?

1. My supervisor wouldn't know.
2. Yes.
3. No.

**022.** How much confidence do you have using your computer to meet the needs of your job?

1. Very low confidence.
2. Low confidence.
3. Moderate confidence.
4. High confidence.
5. Very high confidence.

**023.** Do you feel that you could be more productive in your job if you had stronger computer skills?

1. No.
2. I don't know.
3. Yes, A VERY LITTLE MORE.
4. Yes, A LITTLE MORE.
5. Yes, MORE.
6. Yes, MUCH MORE.
7. Yes, VERY MUCH MORE.

## Part 2

This part of the survey examines the types of end-user support you may require, the importance of that type of support, where you received that support, and how satisfied you were with that support.

There are 14 types of support you will be asked about. Each type of support is identified in bold letters followed by its definition.

The first question following each definition has a Part A and B.

### EXAMPLE:

- 100 A. Did you receive "xxxxxxx" support in the past six months?  
(Fill in "D" for yes. "NA" for no.) If you marked "NA," go to Question 101.
- B. Where did you receive that support? (Select single most important source.)
1. Computer user support office
  2. Information Center
  3. Co-worker
  4. Friend outside of work
  5. Vendor/consultant
  6. Other (fill in on this form)

(SAMPLE)

A	B
<input checked="" type="radio"/> 100	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6

← Response to 100A and 100B

**DEFINITION: ADVISING** helps analyze needs, plan actions, and select products or services up to, but not including, the point of purchase.

**024 A.** Did you receive "advising" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 025.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**025** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**026** How much importance do you place on "advising" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: BACKUP** provides duplicate hardware, software, or data on an on-going basis.

**027 A.** Did you receive "backup" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 028.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**028** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**029** How much importance do you place on "backup" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: COMPATIBILITY** insures hardware, software, and data all work together.

**030 A.** Did you receive "compatibility" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 031.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**031** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**032** How much importance do you place on "compatibility" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: DEVELOPMENT** helps create or enhance a process, program, product, or data set.

**033 A.** Did you receive "development" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 034.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**034** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**035** How much importance do you place on "development" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: DOCUMENTATION** provides descriptions of how to use a computing resource.

**036 A.** Did you receive "documentation" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 037.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**037** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**038** How much importance do you place on "documentation" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: HOTLINE/DEBUGGING.** Users isolate and correct hardware/software problems through the use of a special phone line manned by experts.

**039 A.** Did you receive "hotline/debugging" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 040.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**040** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**041** How much importance do you place on "hotline/debugging" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: LISTING OF RESOURCES** identifies hardware, software, or data that is available from other users within the organization.

**042 A.** Did you receive "listing of resources" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 043.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**043** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor



**044** How much importance do you place on "listing of resources" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: MAINTENANCE** keeps the system in working order; includes tests, measurements, replacements, repairs, and adjustments.

**045 A.** Did you receive "maintenance" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 046.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**046** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**047** How much importance do you place on "maintenance" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: DATA TRANSFER** moves data from one system to another.

**048 A.** Did you receive "data transfer" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 049.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**049** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**050** How much importance do you place on "data transfer" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: NEWSLETTER** produces and distributes information about new products or services for users, training schedules, user tips, etc. Could be on-line or hardcopy.

**051 A.** Did you receive "newsletter" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 052.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**052** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**053** How much importance do you place on "newsletter" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: PURCHASE ASSISTANCE** provides support (forms preparation, identification of potential vendors, etc) for users who are buying a system after the organization has made a decision to buy one.

**054 A.** Did you receive "purchase assistance" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 055.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**055** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**056** How much importance do you place on "purchase assistance" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: RECOVERY** restores hardware, software, or data after a one-time catastrophic failure.

**057 A.** Did you receive "recovery" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 058.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form)\_\_\_\_\_

**058** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**059** How much importance do you place on "recovery" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: RESEARCH PRODUCTS** investigates NEW products and services for possible future use by end-users.

**060 A.** Did you receive "research products" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 061.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**061** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**062** How much importance do you place on "research products" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

**DEFINITION: TRAINING** provides users with knowledge to develop and/or use systems.

**063 A.** Did you receive "training" support in the past six months?

(Fill in "D" for yes, "NA" for no.) If you marked "NA," go to Question 064.

**B.** Where did you receive that support? (Select single most important source.)

1. Computer user support office
2. Information Center
3. Co-worker
4. Friend outside of work
5. Vender/consultant
6. Other (fill in on this form) \_\_\_\_\_

**064** Please rate your level of satisfaction with the source of this support.

1. I did not need this type of support.
2. I needed this support but could not get it.
3. Excellent
4. Good
5. Fair
6. Poor
7. Very Poor

**065** How much importance do you place on "training" support?

1. Very low importance
2. Low importance
3. Moderate importance
4. High importance
5. Very high importance

PLEASE ANSWER THE FOLLOWING TWO QUESTIONS ON THE BLANK PAGE.

**066** What other types of support did you receive, where did you get it,  
and how satisfied were you with that support?

**067** What other types of support are needed and how important are they?



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS UNITED STATES AIR FORCE  
WASHINGTON, D.C. 20330

REPLY TO  
ATTN OF:

SAF/AAI

12 JUN 1991

SUBJECT:

Computer Users Support Survey

TO: Survey Participant

1. Please take a few minutes to complete the attached questionnaire and return it in the enclosed envelope by 30 June 1991.

2. This survey measures your level of experience in computing and asks you to identify the types of support you need. Additionally, it measures your satisfaction with the support you have already received. The information you provide will become part of an Air Force Institute of Technology (AFIT) research project and will help us to determine whether or not the Air Force is providing the type of support our computer users need.

3. Your responses will be combined with those from other respondents and will not be attributed to you personally. Although your participation is completely voluntary, I would appreciate your help. If you have any questions, please contact Major Maureen Casey or Capt Doug Kveene at AFIT/LGS, DSN 785-8989.

*Edward A. Pardini*  
EDWARD A. PARDINI, Colonel, USAF  
Director of Information Management

- 3 Atch  
1. Survey  
2. Computer Answer Sheet  
3. Return Envelope

FROM: 2012 CS/XP

SUBJECT: Survey Distribution Instructions (SCN 91-42)

TO: Computer Equipment Account Custodian

1. From your records as Computer Equipment Account Custodian, select the first listing of those authorized to use a particular computer or computer terminal.
2. Select the fifth name that appears on the list.
  - a. If that individual is not in the Air Force, select the next name on the list that belongs to an Air Force member.
  - b. If the selected person is currently on leave or TDY, select the next name on the list that belongs to an Air Force member who is also currently present for duty.
  - c. If there are less than five names on the list, continue numbering from the top of the list. For example, if there are four names on the list, the first name becomes number five. If there are three names on the list, the second name becomes number five.
3. Give the attached envelope to the person selected according to paragraph 2 above.
4. Ask that person to complete the enclosed survey, seal it in the envelope provided, and return it to you in three days or less.
5. When you have the completed survey, forward it to me as soon as possible.
6. These surveys are part of an Air Force research project to determine the support needs of Air Force computer users and to measure how satisfied the computer users are with the support they have received. Your assistance in this effort is greatly appreciated.

DANIEL S. BRICKEY, GS-9, USAF  
Computer Equipment Control Officer

FROM: 2154 CS/SCS

SUBJECT: Survey Distribution Instructions (SCN 91-42)

TO: Computer Systems Security Officer

1. From your records as Computer Systems Security Officer, select the first two listings of those authorized to use a particular computer or computer terminal.
2. Select the fifth name that appears on each list.
  - a. If that individual is not in the Air Force, select the next name on the list that belongs to an Air Force member.
  - b. If either of the selected people are currently on leave or TDY, select the next name on the list that belongs to an Air Force member who is also currently present for duty.
  - c. If there are less than five names on the list, continue numbering from the top of the list. For example, if there are four names on the list, the first name becomes number five. If there are three names on the list, the second name becomes number five.
3. Give one of the attached envelopes to each person selected according to paragraph 2 above.
4. Ask each person to complete the enclosed survey, seal it in the envelope provided, and return it to you in three days or less.
5. When you have both completed surveys, forward them to me as soon as possible.
6. These surveys are part of an Air Force research project to determine the support needs of Air Force computer users and to measure how satisfied the computer users are with the support they have received. Your assistance in this effort is greatly appreciated.

LANCE E. GALLAGHER, MSgt, USAF  
Base Computer Systems Security Officer



FROM: 437 CS/SCP

SUBJECT: Survey Distribution Instructions (SCN 91-42)

TO: Computer Systems Security Officer

1. From your records as Computer Systems Security Officer, select the first three listings of those authorized to use a particular computer or computer terminal.
2. Select the fifth name that appears on each list.
  - a. If that individual is not in the Air Force, select the next name on the list that belongs to an Air Force member.
  - b. If either of the selected people are currently on leave or TDY, select the next name on the list that belongs to an Air Force member who is also currently present for duty.
  - c. If there are less than five names on the list, continue numbering from the top of the list. For example, if there are four names on the list, the first name becomes number five. If there are three names on the list, the second name becomes number five.
3. Give one of the attached envelopes to each person selected according to paragraph 2 above.
4. Ask each person to complete the enclosed survey, seal it in the envelope provided, and return it to you in three days or less.
5. When you have all three completed surveys, forward them to me as soon as possible.
6. These surveys are part of an Air Force research project to determine the support needs of Air Force computer users and to measure how satisfied the computer users are with the support they have received. Your assistance in this effort is greatly appreciated.

EDWARD JENNINGS, TSgt, USAF  
NCOIC, Small Computer Support Office



DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY  
AIR FORCE INSTITUTE OF TECHNOLOGY  
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

FROM: Capt Douglas A. Kveene

SUBJ: End-User Computing Survey

TO: Survey Participants

Thank you for taking time to complete the enclosed survey. Your responses are invaluable to me as I conduct research toward my thesis at the Air Force Institute of Technology. Let me give you a brief summary of what my research is all about.

I am studying end-user computing at civilian organizations and Air Force installations. By definition, you are an end-user because you interact with a computer. Through your collective responses, I am measuring the types of support you need and how important that support is to you. I am also measuring the sources of support you receive help from and your level of satisfaction with those sources of support. My objective is to compare the data from civilian organizations against the data from Air Force installations and draw some conclusions which will be beneficial to the organization I work for -- the United States Air Force.

I have tried to make the survey as easy as possible. It should only take you 15 minutes to complete. Your responses will be combined with those from other survey respondents and will not be attributed to you personally. You will remain anonymous.

Thanks again for helping me complete my research.

*Douglas A. Kveene*

DOUGLAS A. KVEENE, Capt, USAF  
Graduate Student  
Air Force Institute of Technology

## Appendix B: Survey Approval Request

### REQUEST FOR APPROVAL OF SURVEY

AFIT/GIR/LSR/91D-2  
Major Maureen C. Casey  
Captain Douglas A. Kveene

1. TITLE OF PLANNED SURVEY.

Computer Users Support Survey

2. NAME AND ADDRESS OF INDIVIDUAL REQUESTING APPROVAL.

AFIT Survey Control Officer

AFIT/XP, Lt Frisco-Foy, (DSN 785-4219) Wright-Patterson AFB Ohio  
45433-6583

Thesis Advisor

AFIT/LSR, Major Wayne Stone, (DSN 785-4529) Wright-Patterson AFB  
Ohio 45433-6583

3. STATEMENT OF SURVEY PROBLEM, SURVEY PURPOSE, PREFERRED ADMINISTRATIVE TIME FRAME, AND JUSTIFICATION.

a. SURVEY PROBLEM.

In 1974, IBM created the Information Center to provide support to computer end-users. In 1984, a research firm in Santa Monica, California, CRWTH, reported that there were 2,100 information centers in operation. Although many organizations established information centers to support their computer end-users, other organizations did not adopt the information center concept. The Air Force falls into this last group. Because of the Air Force's substantial investment in hardware and software, it is appropriate to ascertain if the Air Force is receiving optimum benefit from microcomputer use without providing computer end-user support through information centers.

b. SURVEY PURPOSE.

The purpose of this study is to determine whether or not an information center is an appropriate means of providing support to computer end-users in the Air Force.

c. PREFERRED ADMINISTRATIVE TIME FRAME.

As soon as practical. Survey data must be collected by 30 June 1991 for meaningful analysis.

#### d. JUSTIFICATION FOR SURVEY.

In light of recent budget reductions, the current state of the economy, and the general political climate, it would appear that the military can look forward to a prolonged period of tight fiscal constraint. Even if these observations and assumptions are not valid, it is certainly prudent for any organization to attempt to optimize its resources. Since the introduction of the personal computer, the Air Force has purchased a considerable number of microcomputers. The purpose of this study, to determine whether or not information centers would be an appropriate means of providing support to the many computer end-users in the Air Force, is of great significance. This significance fully justifies this research study.

#### 4. HYPOTHESES TO BE TESTED BY THE SURVEY.

The following investigative questions need to be answered in order to solve the research problem:

- a. What are the groups that computer end-users fall into?
- b. What is the distribution of computer end-users in each grouping?
- c. What types of support do computer end-users require?
- d. How important to computer end-users are each of the types of support?
- e. Where do computer end-users get the support they need?
- f. How satisfied are computer end-users with the support they receive?
- g. What is the relationship between the source of support and the level of satisfaction with that support.

#### 5. POPULATION TO BE SURVEYED.

##### a. DESCRIPTION OF POPULATION TO INCLUDE MILITARY AND CIVILIAN EMPLOYMENT STATUS AND BY WHOM EMPLOYED.

The population of interest for this study is composed of all active duty Air Force members who use a microcomputer or a mainframe computer terminal in the performance of their military duties.

##### b. SIZE OF POPULATION.

Unknown. The true population could include all current active duty Air Force personnel.

6. DESCRIPTION AND SIZE OF SAMPLE SELECTED.

a. SAMPLE DESCRIPTION.

The sample will be selected from all authorized computer end-users at Whiteman AFB (SAC), Missouri, Seymour Johnson AFB (TAC), North Carolina, and Charleston AFB (MAC), South Carolina.

b. SIZE OF SAMPLE AND IF INDIVIDUAL RESPONDEES ARE KNOWN OR NOT KNOWN.

The total sample size will be 450, 150 from each of the three bases identified in 6a. above. The names of individual respondents are not known.

7. METHOD OF SELECTION OF THE SAMPLE.

a. Whiteman AFB: Two surveys will be sent to each of the 75 computer systems security officers with instructions to select the fifth name on the first two authorized computer users lists for their unit. The surveys are to be given to the two military people to complete. If either of those two people are unavailable due to leave or TDY, the next military name on the list is to be selected. If there are less than five names on the list, numbering will continue from the top of the list. For example, if there are four names on the list, the first name becomes number five. If there are three names on the list, the second name becomes number five.

b. Seymour Johnson AFB: One survey will be sent to each of the first 150 computer equipment account custodians listed with the 2012th Communications Squadron's XP office. The equipment account custodian will be instructed to select the fifth name on the first authorized computer users list for their account. The surveys are to be given to that military person to complete. If that person is unavailable due to leave or TDY, the next name on the list is to be selected. If there are less than five names on the list, numbering will continue from the top of the list. See examples given in 7a. above.

c. Charleston AFB: Three surveys will be sent to each of the 50 computer systems security officers with instructions to select the fifth name on the first three authorized computer users lists for their unit. The surveys are to be given to those three military people to complete. If any of those three people are unavailable due to leave or TDY, the next name on the list is to be selected. If there are less than five names on the list, numbering will continue from the top of the list. See examples given in 7a. above.

8. METHOD OF CONDUCTING THE SURVEY.

Questionnaires will be distributed to respondents through their units as described in 7 above. Completed questionnaires will be mailed back by each individual.

9. DESCRIPTION OF THE STATISTICAL ANALYSIS PLAN OR OTHER METHOD OF EVALUATION.

Information will be evaluated through cumulative frequency distribution histograms and multi-variate regression analyses.

10. METHOD OF TABULATING SURVEY RESULTS.

Completed surveys will be optically scanned by AFIT/SC to create a database for statistical analysis using SASS.

11. USE AND DISTRIBUTION OF RESULTS.

The survey results will be basic inputs to a published Air Force Institute of Technology, School of Systems and Logistics, graduate student thesis. The results may be released to the public and the Air Force Human Resources Laboratory in compliance with AFR 12-30.

12. COMMAND APPROVAL CONTACT POINT.

SAF/AAI, Colonel Edward A. Pardini, (DSN 225-1667) HQ USAF, Pentagon, Washington DC 20330

13. Copy of the proposed survey questionnaire is attached.

## Appendix C: Summary of Written Comments

### Air Force

Question 6. Indicate the highest level of computer training you have completed.

Some respondents indicated they had received training at a technical school, as part of on-the-job training, or as a result of their own studies.

Question 12 - 16. Rate how confident you feel using that application.

Table 20 lists the applications identified by the respondents.

Question 17. Who uses the results of your computing most often?

There were five responses to this question indicating a major command-level office and one response of a contractor.

Part 2. Where did you receive "xxxxx" support?

There were 11 responses of support provided by a major command-level office and 11 responses of support from Gunter Air Force Base.

Question 66. What other types of support did you receive, where did you get it, and how satisfied were you with that support?

There were no other types of support identified.

Question 67. What other types of support are needed and how important are they?

There were no other types of support identified. However, survey respondents took an opportunity to emphasize how very important specific types of support are. The following types of support were identified from most to least frequently?

Training  
Purchase Assistance  
Systems Interface/Communications  
Maintenance  
Hotline

The following quoted comments give an indication of how emotional and frustrated end users are with regard to support they need but have not received.

I have been in Admin for almost 11 years. I have never been to any formal training in computers, how to's, or any other programs of which the Air Force has on hand or my people order (or I'm told to order) for the office to use. The Air Force teaches how to type but not how to type on the equipment they provide. Software is available with tons of applications but the Admin troops don't have any training on how to use it. I am very disappointed in the fact that we are not afforded the opportunity to be taught these programs. I guess the bottom line is you have spent millions of dollars on equipment that probably is used for games and junk programs than the output of quality, timely work.

Much more training. Although video tapes are OK, classroom training provides for higher learning and should be available on base.

Need a streamlined way to get additional hardware and software in a timely manner. One desk-top computer for an office of eight people, with no secretary, is unacceptable. Additional computers have been on order for months.

Classes are needed that are geared towards particular work and programs that are used by each section, especially PCIII.

If the Air Force is going to an "all computerized" system, then give us the computers and support for those of us who use them.

We need an on-line (BBS, 1-800-#, etc) real time troubleshooting support agency/source. When we need to do some different tasks, the manufacturers don't put in their documentation, an expert source would really help.

We need optimization support. Training/programs that setup/teach what to set up, computers so that we the users can get the most out of them. Needed badly right now Air Force wide.



We also need upgrade support--What's available, what's coming, what it will do...Z-248 may be OK--but they are getting a little grey around the edges.

We are given the equipment we need to buy and the software is designed and implemented at higher headquarters. We have no input. However, some very good enhancement programs have been developed, but not accepted at higher headquarters--so they are illegal to use on system--Why try to improve the designs to make working more efficient when credit is not given to far-end users?

Users need training desperately on most all new applications of PC software.

We need virtually every aspect of support and receive almost none. Daily, we are expected to operate in a computer operative world even by our own headquarters, but do not have the hardware, software, literacy, etc. the attitude seems to be "operate by hook or crook" but there isn't any money to support you..we are on our own.

Table 20

## Other Applications Air Force Respondents Use

APPLICATION	NUMBER OF RESPONSES
CAD	9
Basic	3
DOS	2
Desktop Publishing	2
Fortran	2
Turbo Pascal	2
Enable	2
Pagemaker	1
PC III	1
Pro DOS	1
Flight Simulator	1
BMDs	1
Clipper	1
CAMS	1
ITVS	1
SBSS	1
ADRSS	1
ATOMS	1
MASS	1
MSDS	1
PSM	1
AFORMS	1
EZ Forms	1
PAMS	1
APDS	1
Cobol	1
Mathcad	1
Image	1
SPAS Blotter	1
IPMS	1

Acronyms listed above are exactly what survey respondents replied with no further definition or explanation.

### Civilian Organizations without ICs

Question 6. Indicate the highest level of computer training you have completed.

The majority of the responses indicated on-the-job training was received. Other responses included short, specialized training courses, company courses, and the individual's work experience.

Questions 12-16. Table 48 identifies the additional applications used by end users in civilian organizations without ICs.

Table 21

#### Additional Applications Used by End Users in Organizations Without ICs

CIV W/O IC	
CAD	TMS
CAM	Project Billing
Program Mgt	Dialog
Project Mgt	Mainframe
Desktop Publishing	Finite Element
Network	Data Analysis
E-mail	Scientific Calc
SAS	STAR
ANSYS	DPTV System
Timeline	FEM
Calendar Mgt	Inventory Mgt
Engineer Design	Purchasing Mgt
Simulation	Search
Scheduling	DACOR
Programming	VAX II Scheduling
SPSS	

Applications are reported as the respondent indicated them.

Question 17. Who uses the results of your computing most often?

The following responses were reported in addition to those provided by the survey: Printing Dept, Publication Audience, Management Team, Supplier/Customer.

Question 66. What other types of support did you receive, where did you get it, and how satisfied were you with that support?

End users did not always answer all three questions, however the following responses were reported: Windows training, NERAC comparative analysis training (adequate), SAS from the GM Technical Center (satisfactory), telephone support (excellent), PC training, moving equipment to a new office.

Question 67. What other types of support are needed and how important are they?

End users identified a variety of additional types of support they required as well as reiterated some existing support from the survey. Training was the number one request. Training requests were for mainframe, SAS, database, and word processing. Others included software application options, compatibility standards from vendors, PC disk optimization, maintenance support for night shifts, networking, and more company-licensed software.

#### Civilian Organizations with ICs

Question 6. Indicate the highest level of computer training you have completed.

The majority of the responses indicated in-house training or on-the-job training. One response included a trade school.

Questions 12-16. Table 49 identifies the additional applications used by end users.

Table 22

Additional Applications Used by End Users  
in Organizations With ICs

CIV W/ IC	
Novell Network	Fortran
CAD	Program Mgt
Purchasing	Engineering
Simulation	Accounting
Forms/Label	Project Mgt
Applications are reported as the respondent indicated them.	

Question 17. Who uses the results of your computing most often?

The only two responses received were the sales force and the Pension Advisory Committee.

Question 66. What other types of support did you receive, where did you get it, and how satisfied were you with that support?

End users indicated they received good communications support from the vender and excellent hardware wiring support from the telecommunication group.

Question 67. What other types of support are needed and how important are they?

The following types of support were all deemed very important: training, repair, interoperability advice to interface different systems, WAN support to install network systems, advanced courses in Dataease, Word Perfect, and DOS. Training seemed to be the number one request.

Appendix D: Percentages of Each Type of Support Required by Each Sample and Percentages of Each Type of Support Provided by Each Source

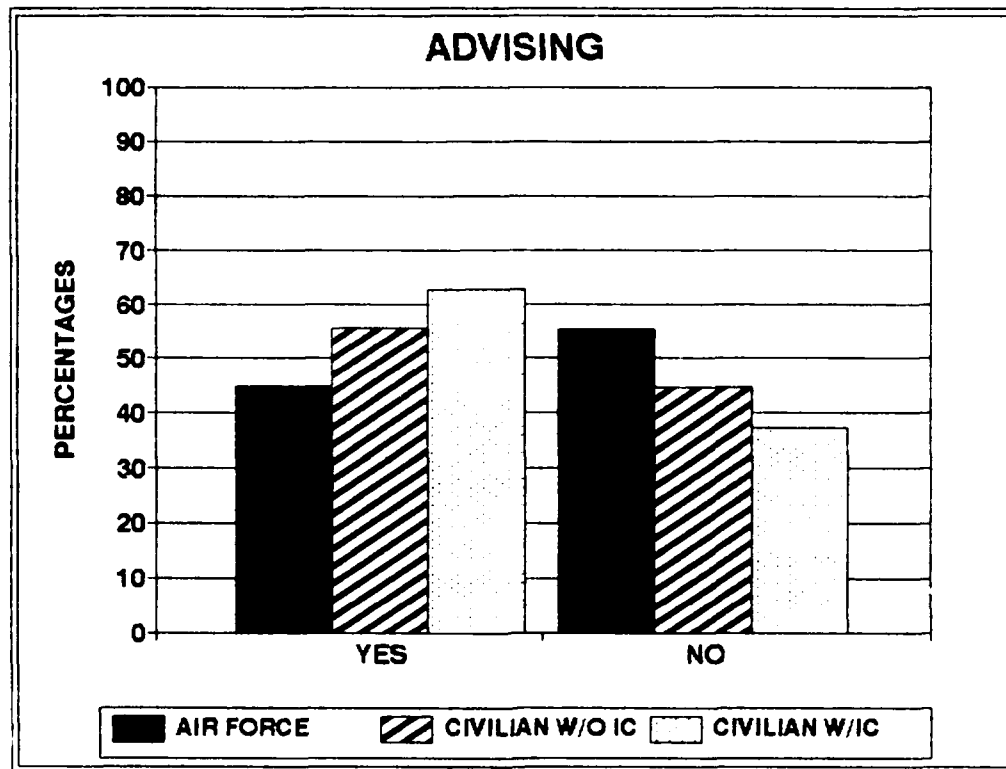


Figure 18. Percent Requiring Advising Support

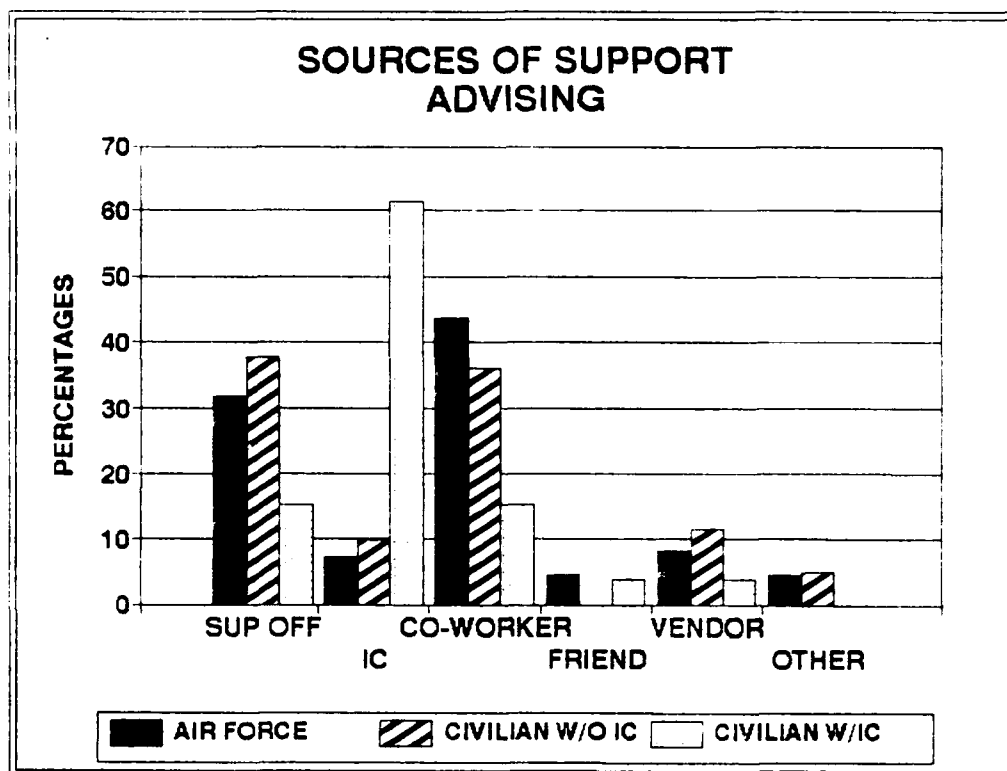


Figure 19. Percent of Advising Support by Source

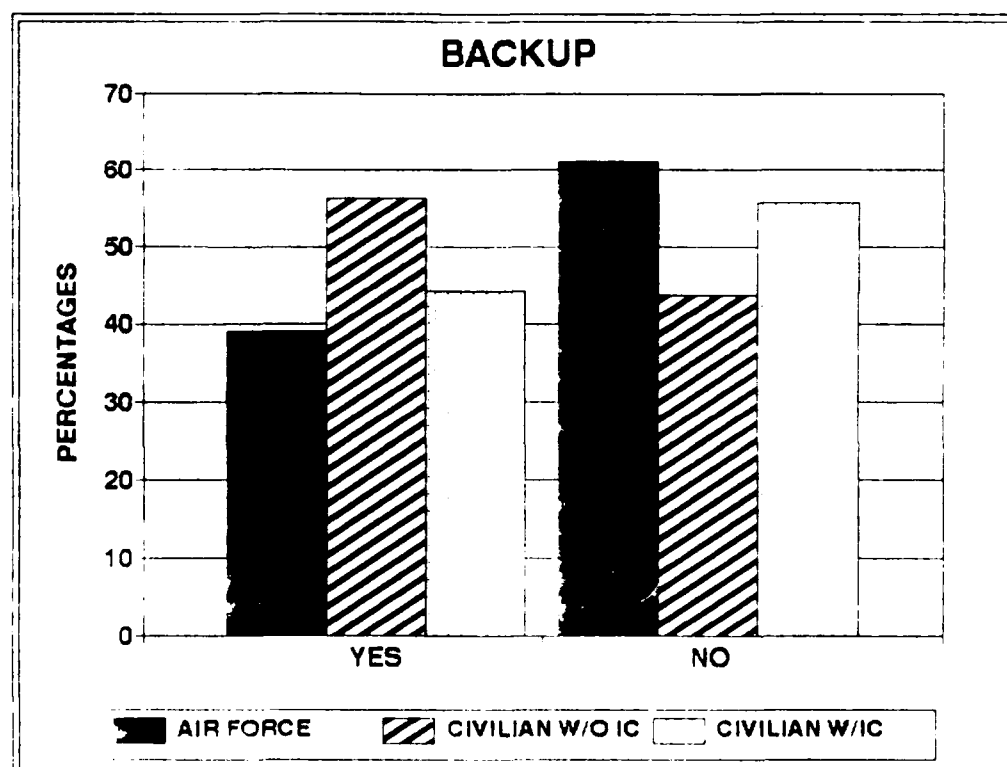


Figure 20. Percent Requiring Backup Support

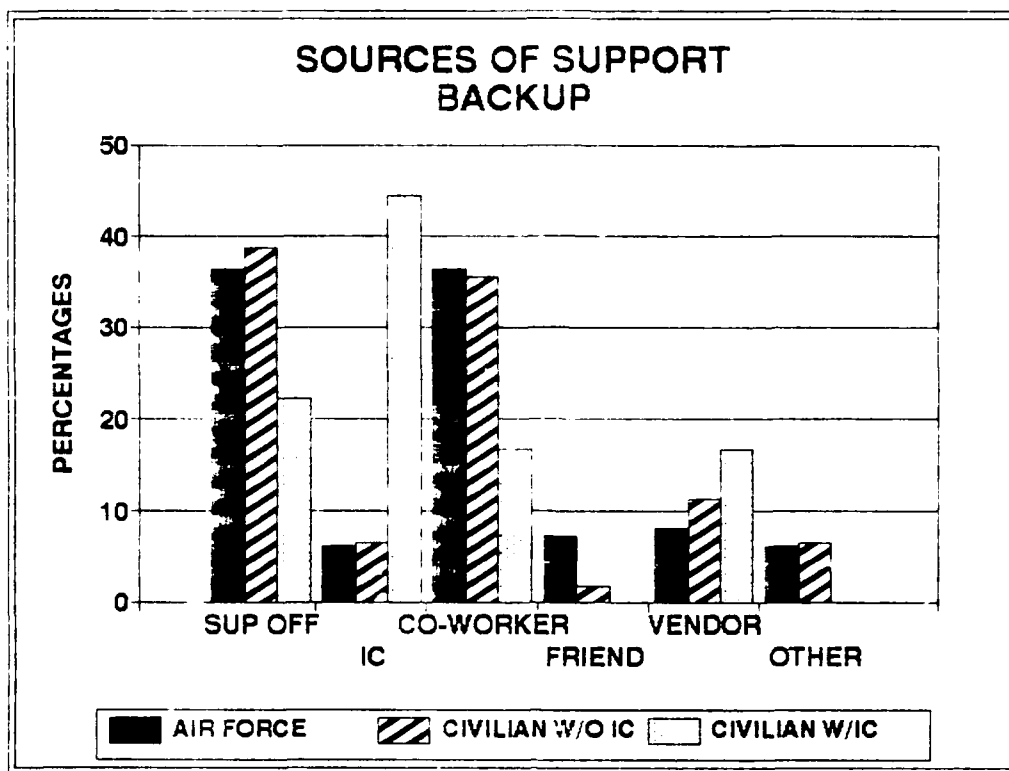


Figure 21. Percent of Backup Support by Source

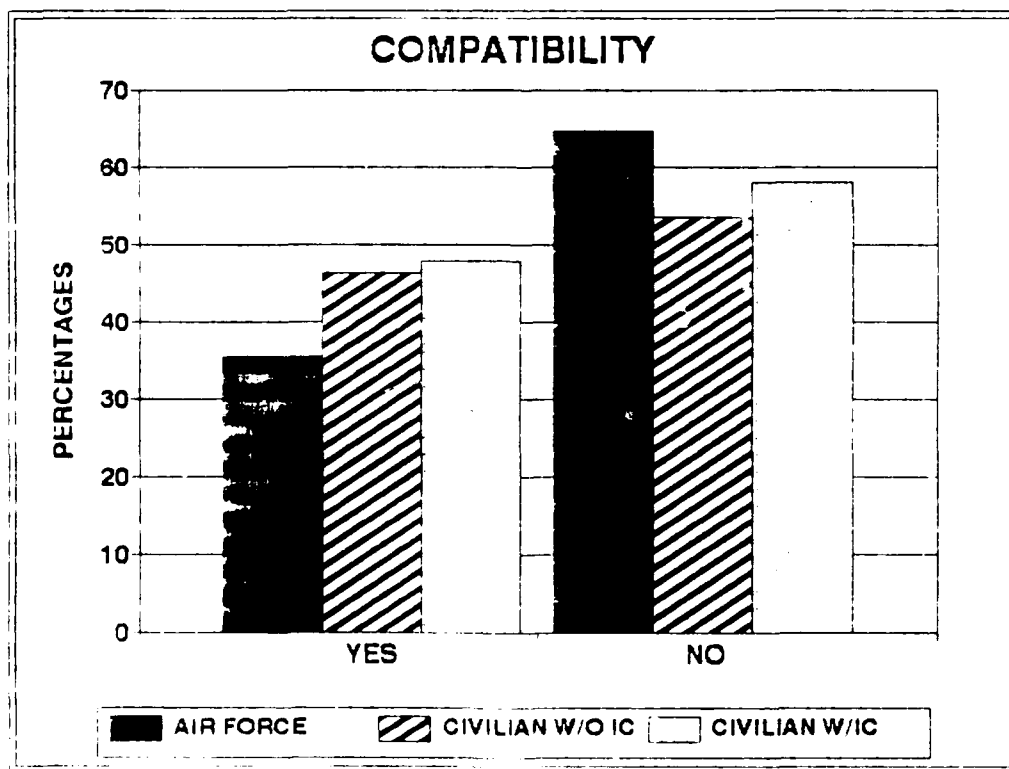


Figure 22. Percent Requiring Compatibility Support



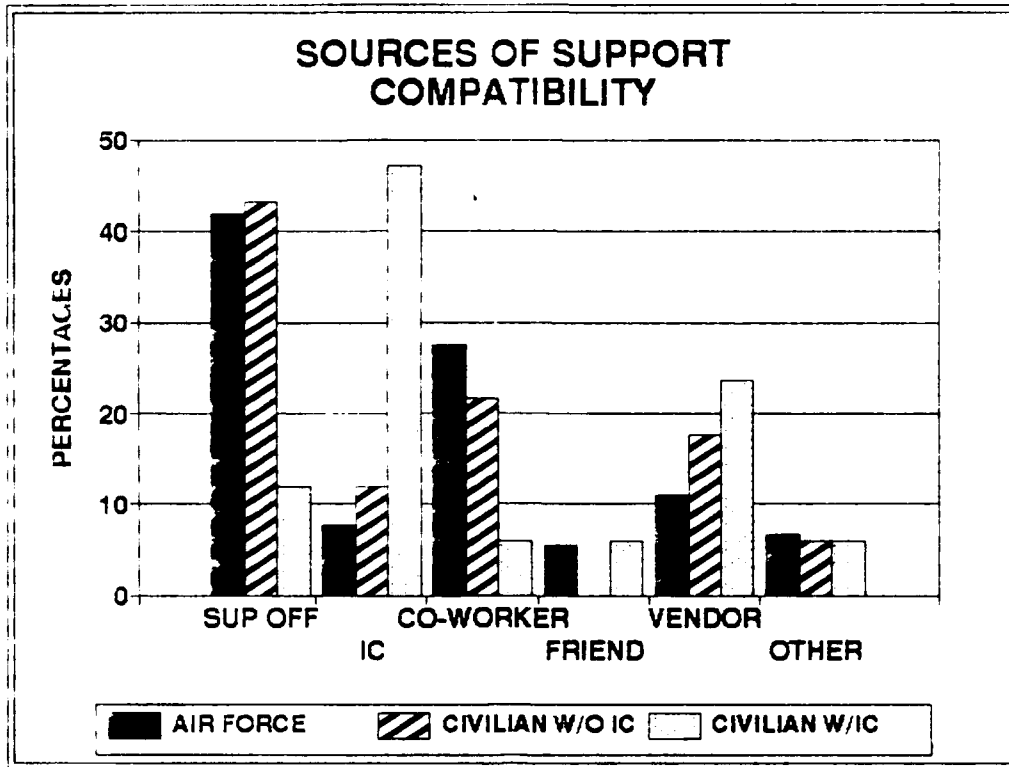


Figure 23. Percent of Compatibility Support by Source

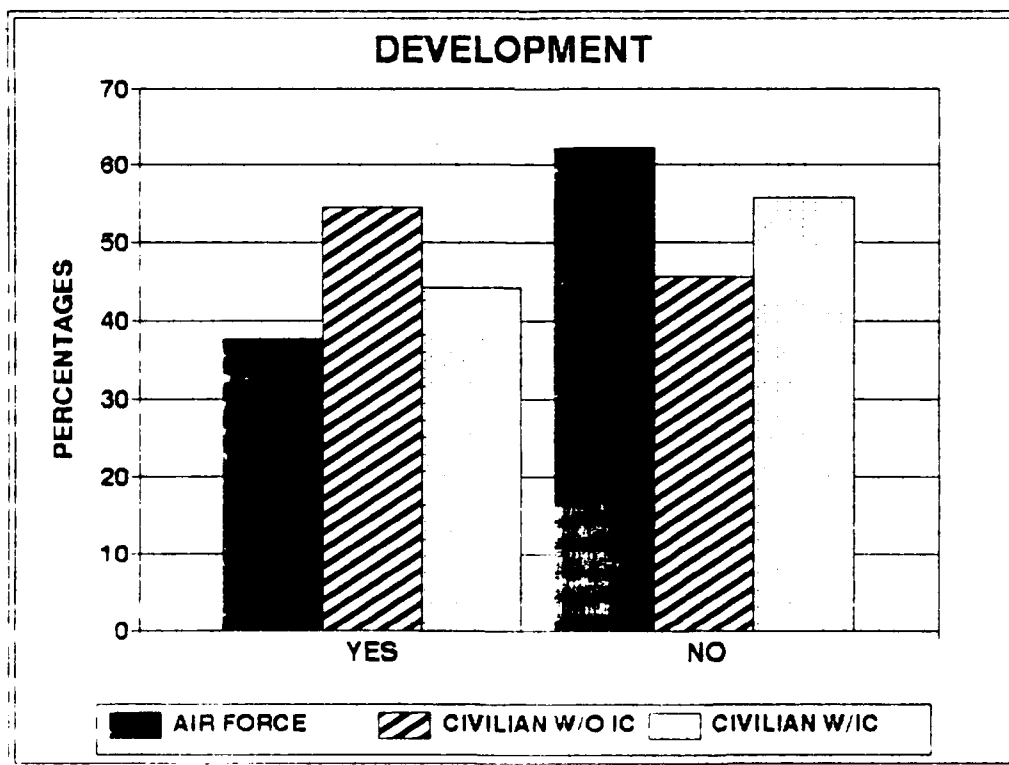


Figure 24. Percent Requiring Development Support

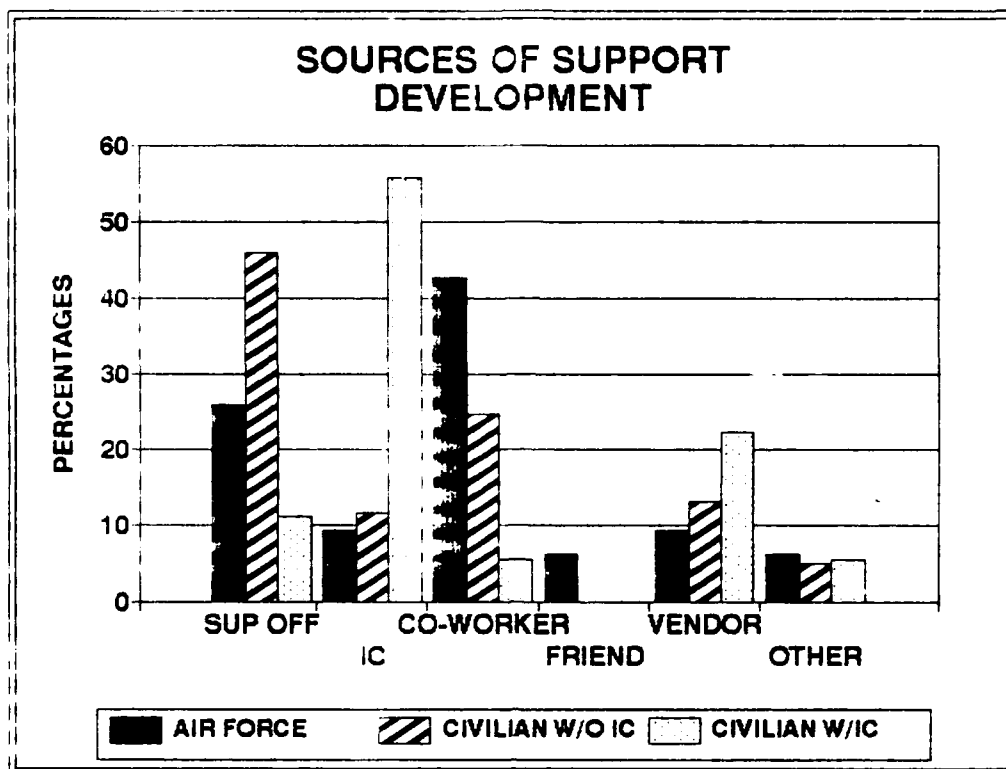


Figure 25. Percent of Development Support by Source

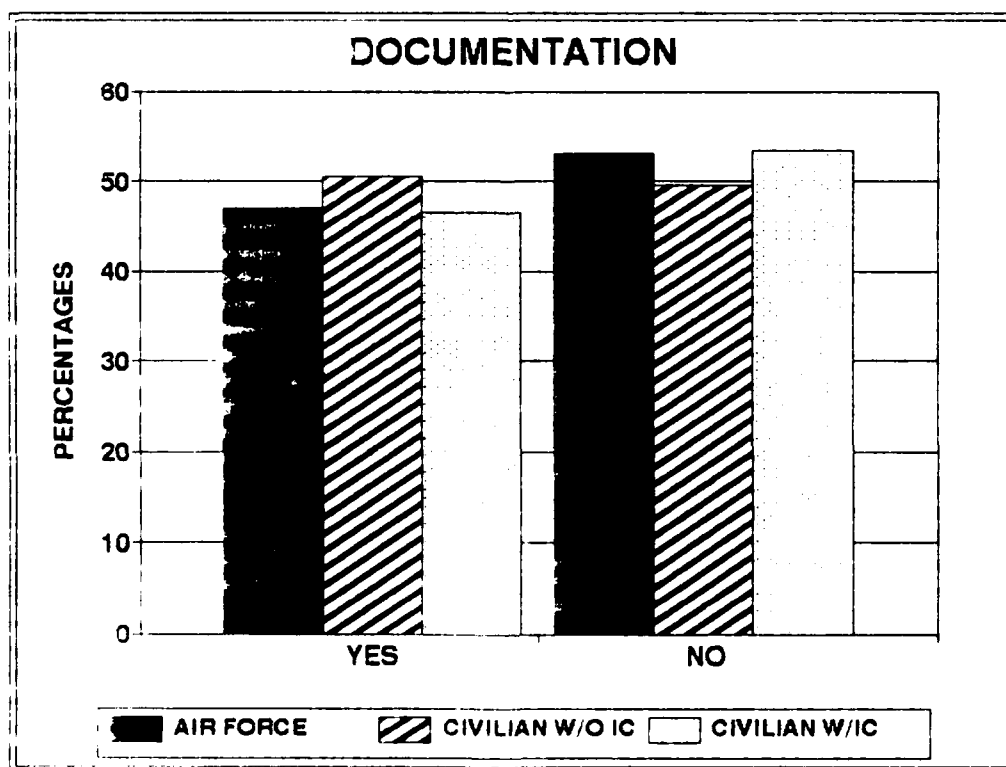


Figure 26. Percent Requiring Documentation Support

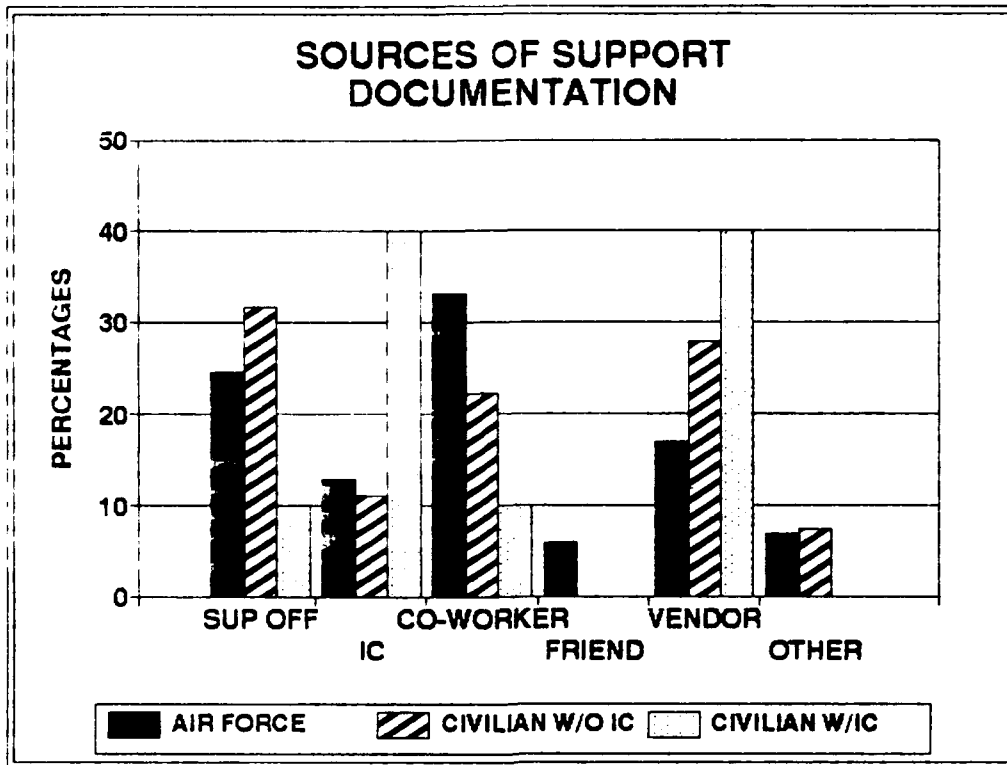


Figure 27. Percent of Documentation Support by Source

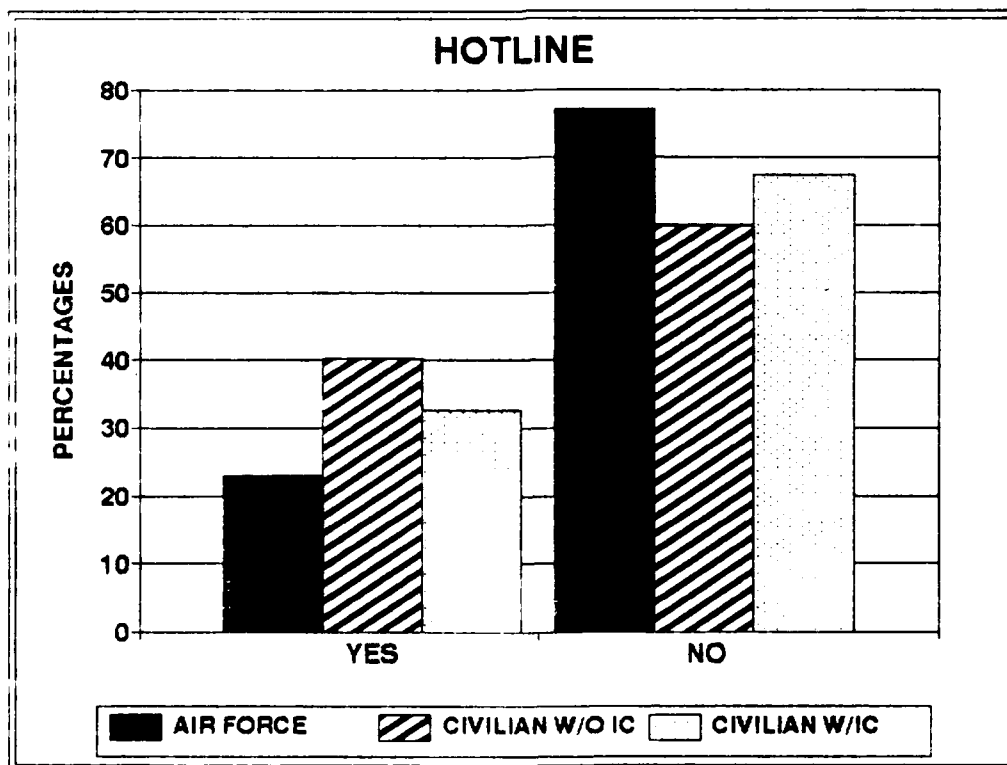


Figure 28. Percent Requiring Hotline Support

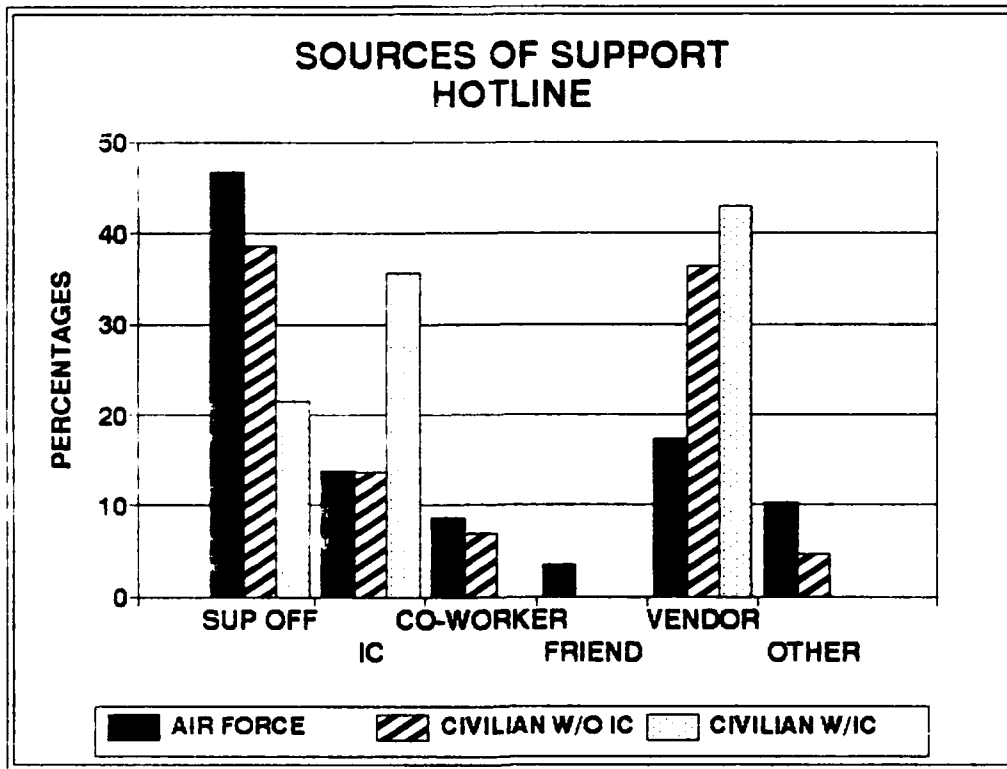


Figure 29. Percent of Hotline Support by Source

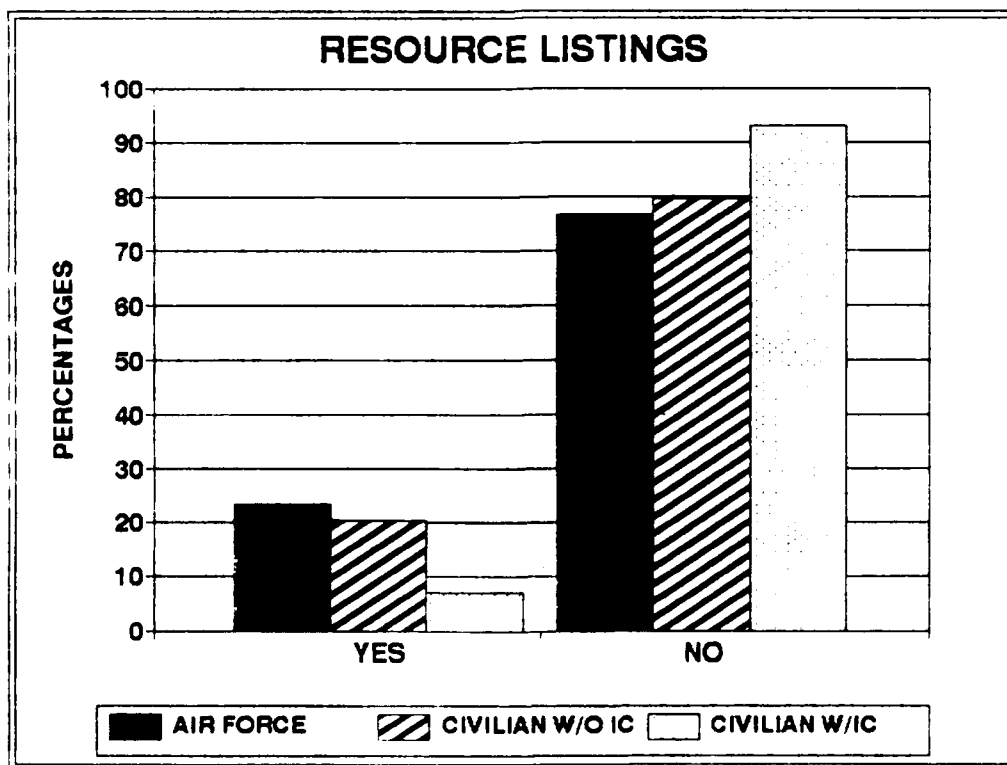


Figure 30. Percent Requiring Resource Listing Support

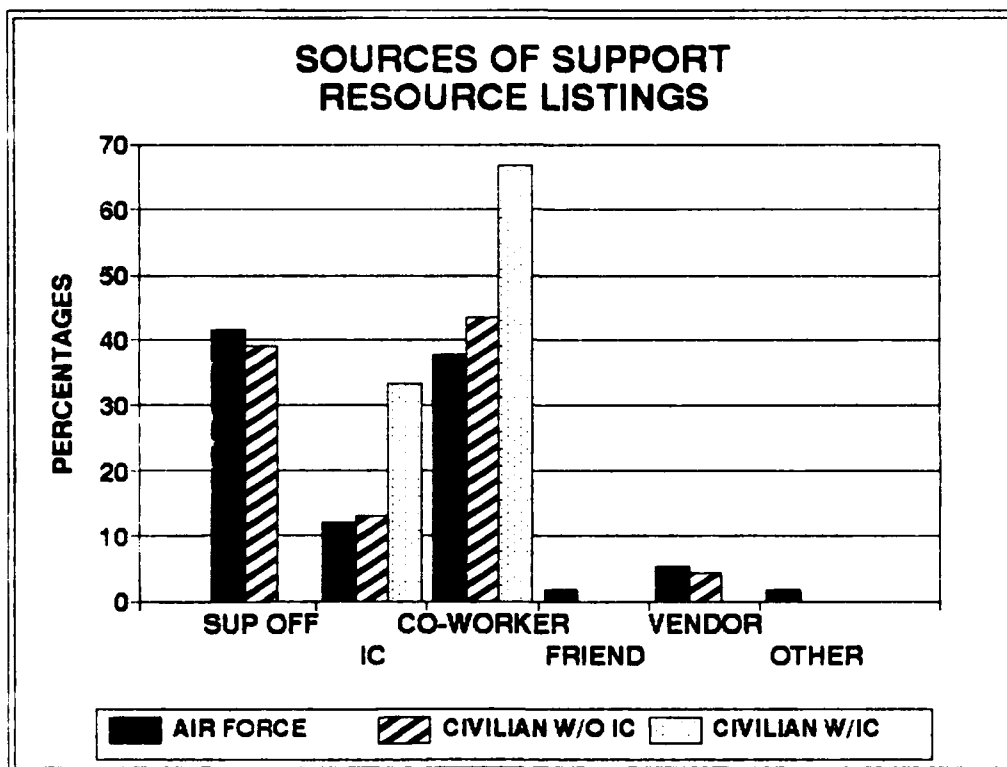


Figure 31. Percent of Resource Listing Support by Source

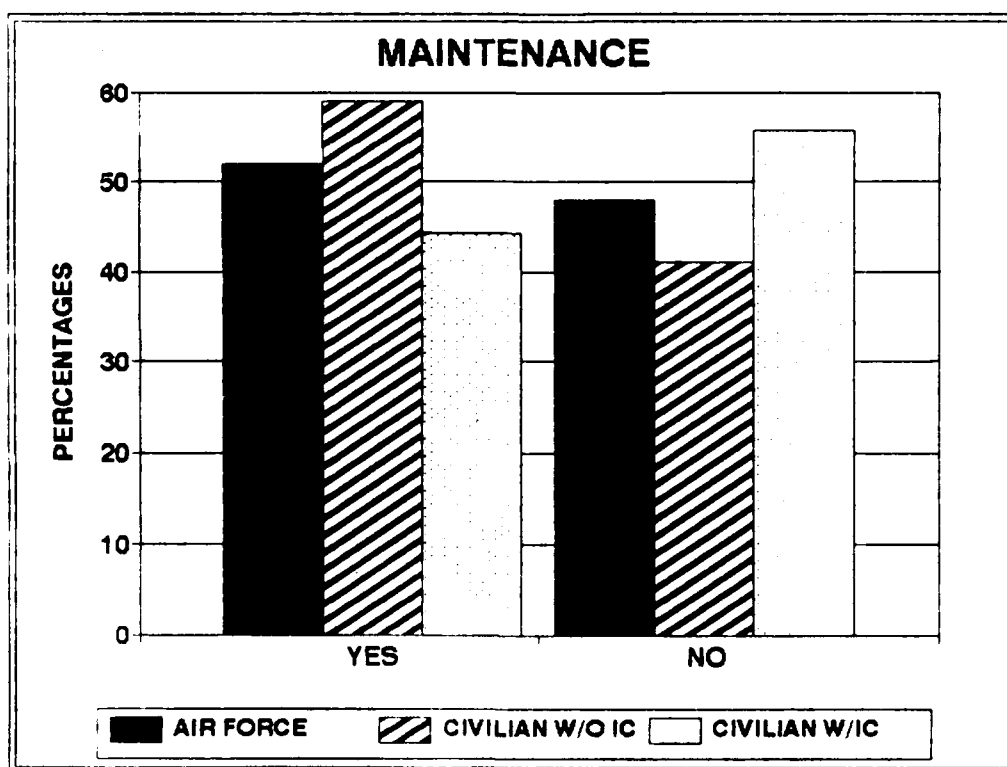


Figure 32. Percent Requiring Maintenance Support

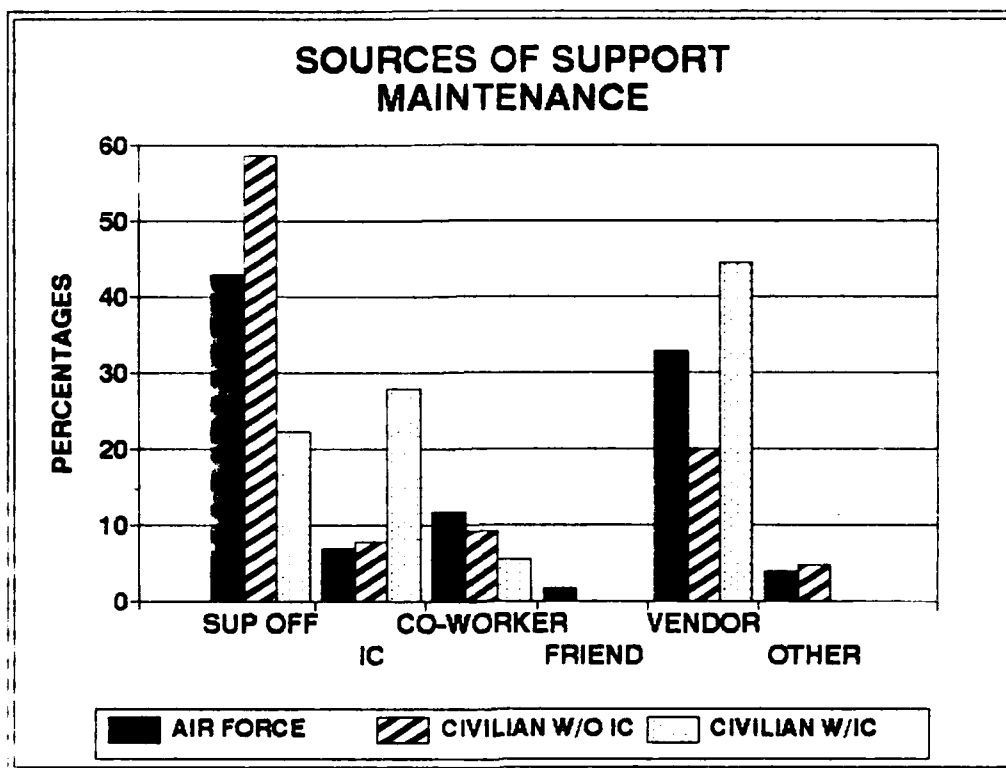


Figure 33. Percent of Maintenance Support by Source

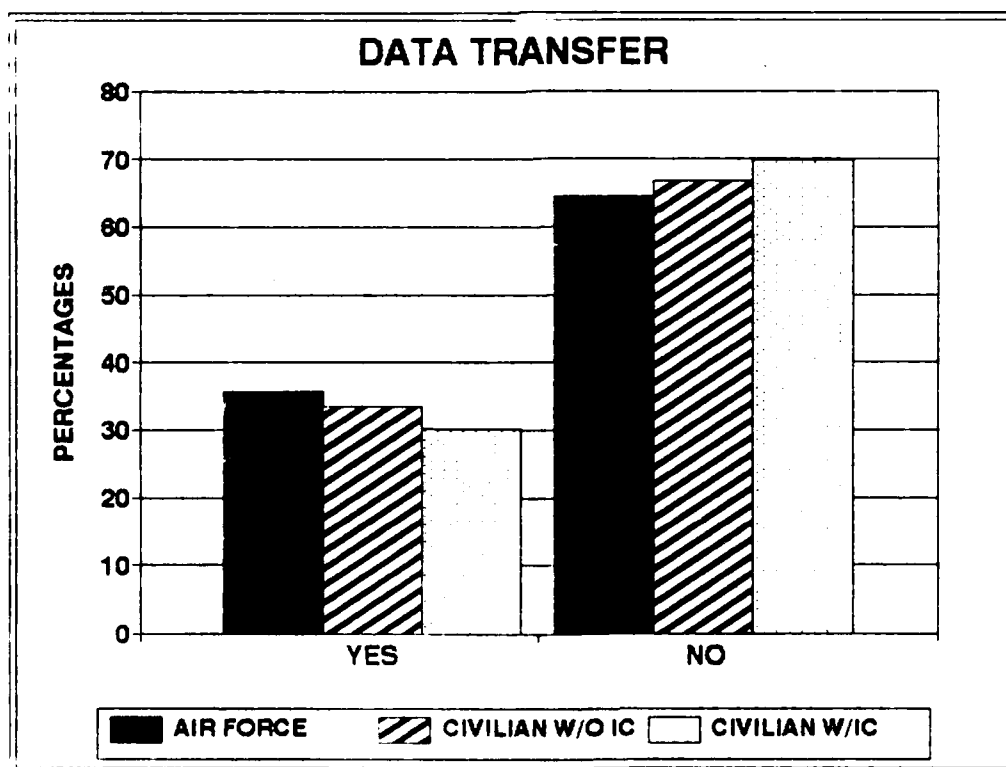


Figure 34. Percent Requiring Data Transfer Support

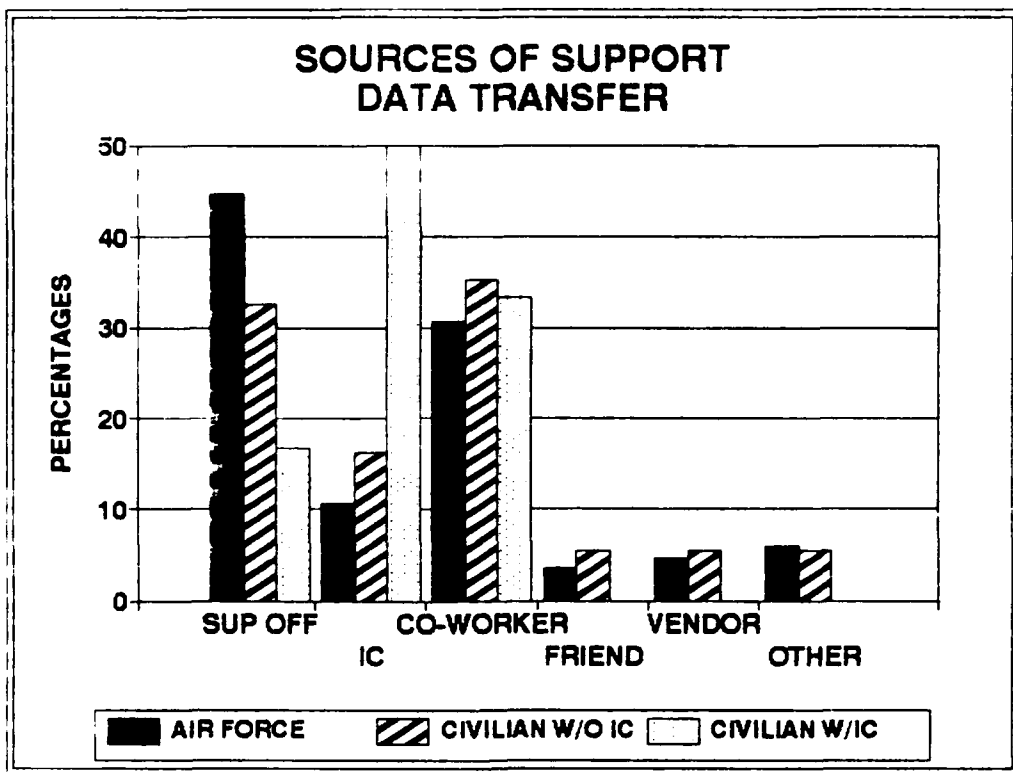


Figure 35. Percent of Data Transfer Support by Source

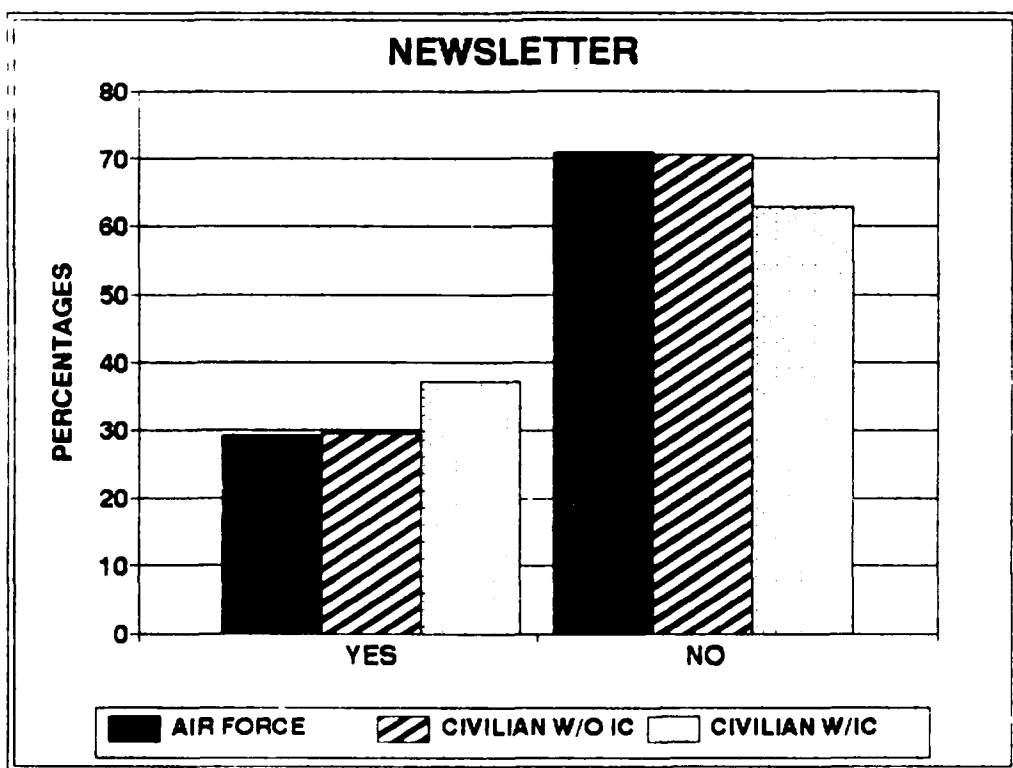


Figure 36. Percent Requiring Newsletter Support

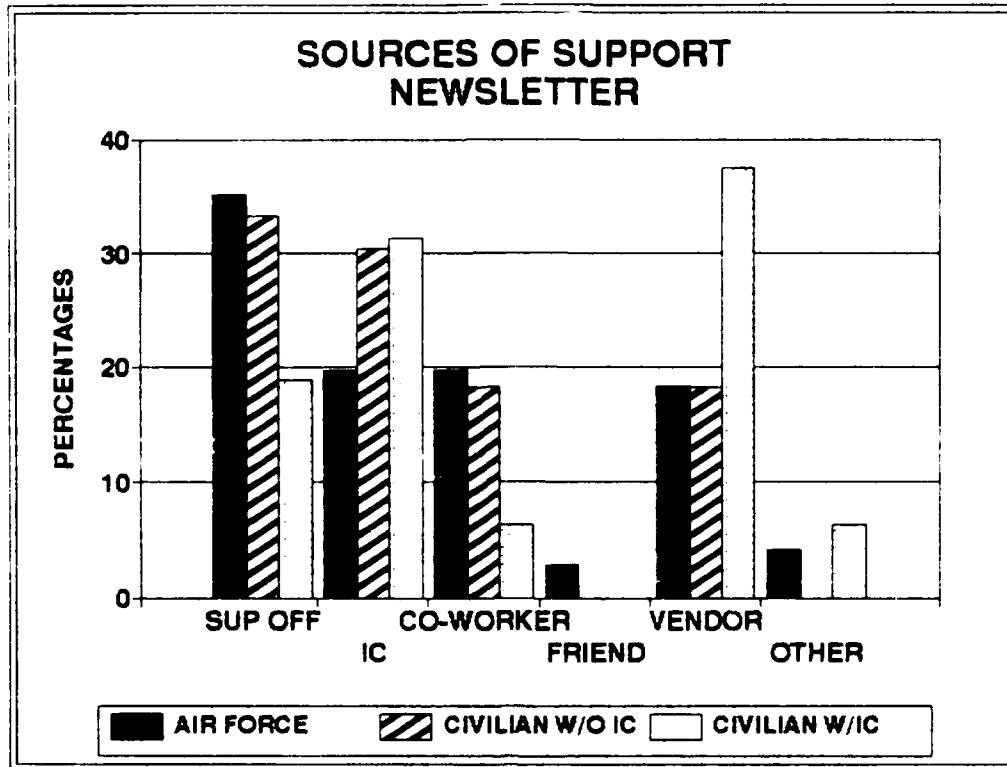


Figure 37. Percent of Newsletter Support by Source

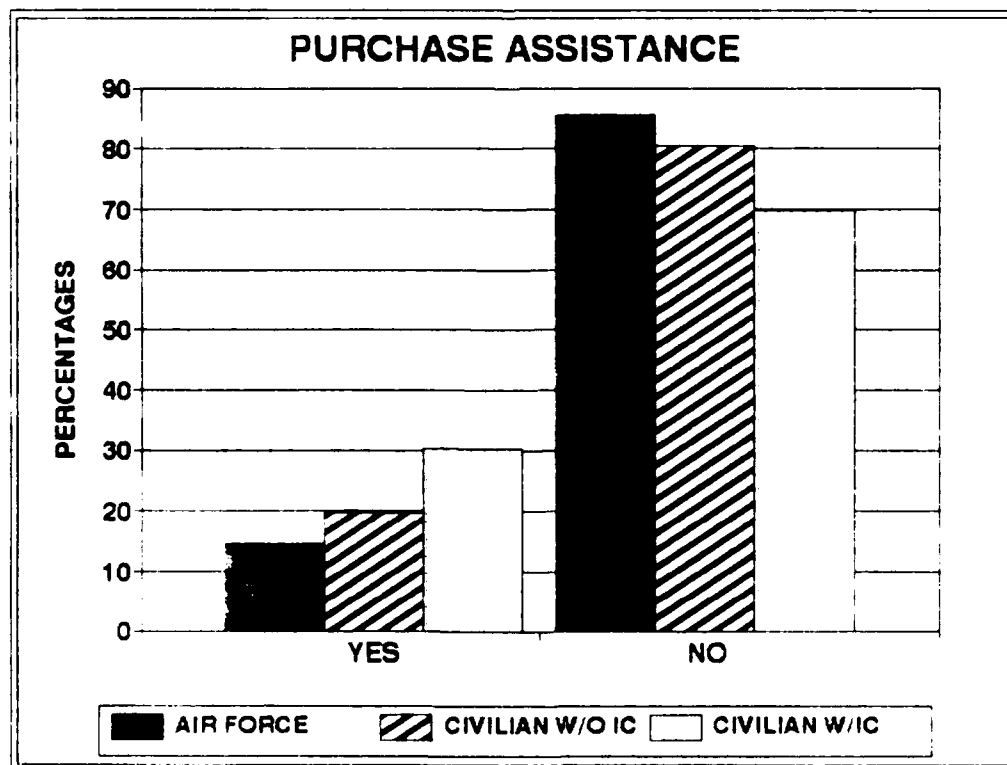


Figure 38. Percent Requiring Purchase Assistance Support



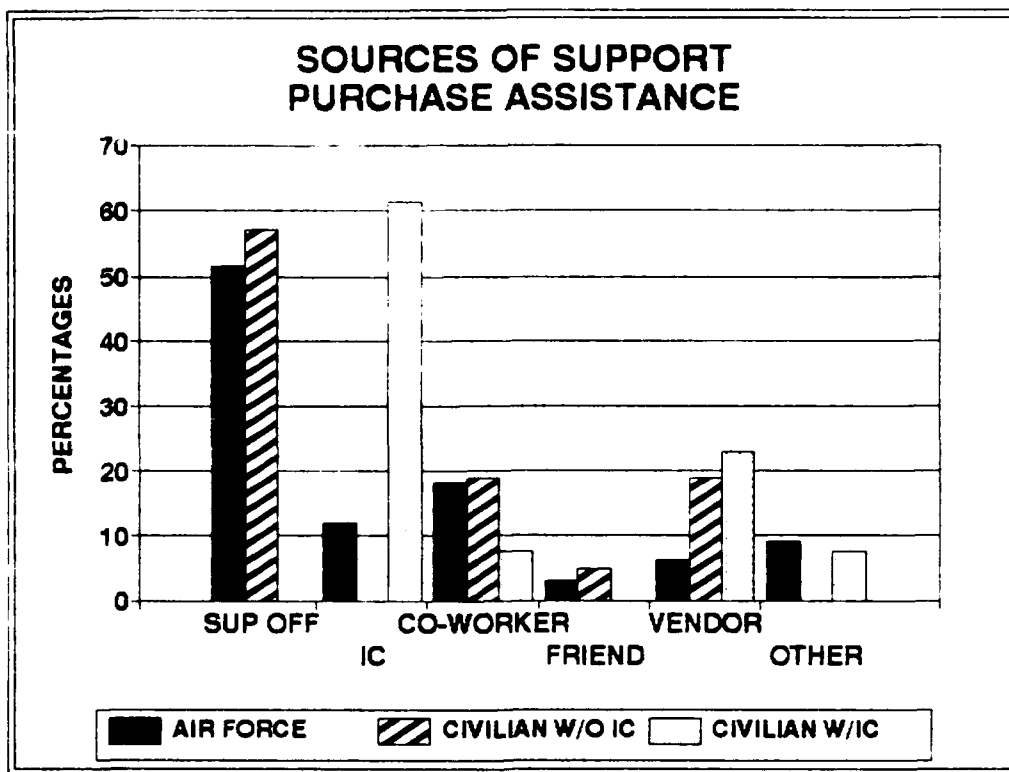


Figure 39. Percent of Purchase Assistance Support by Source

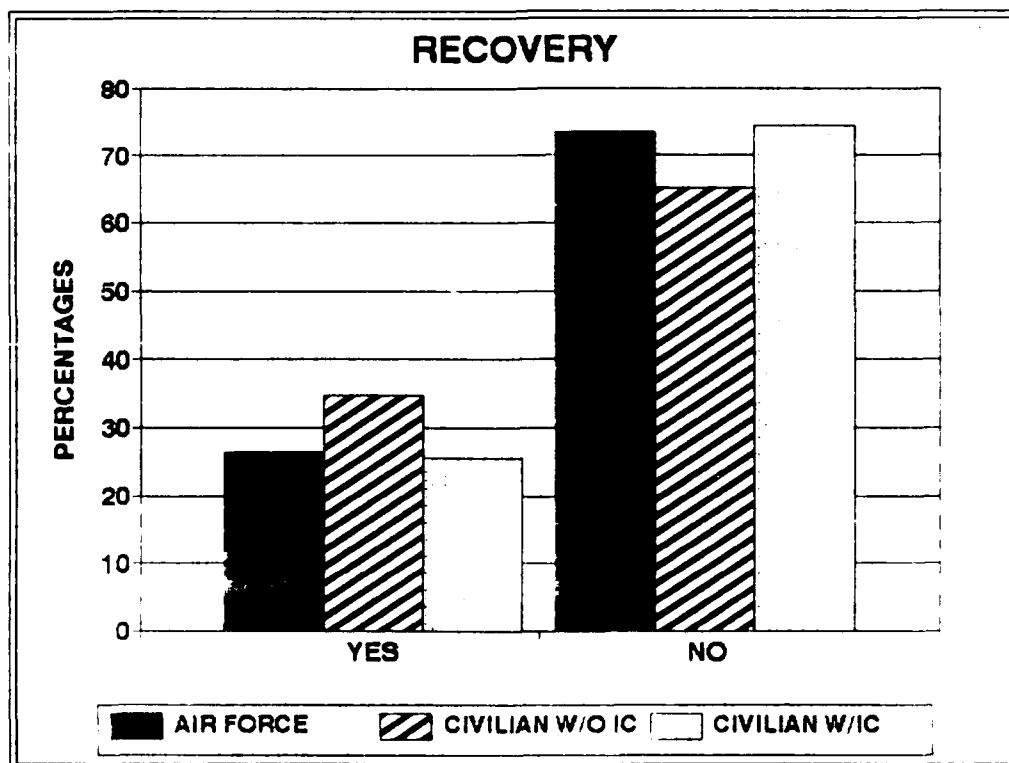


Figure 40. Percent Requiring Recovery Support

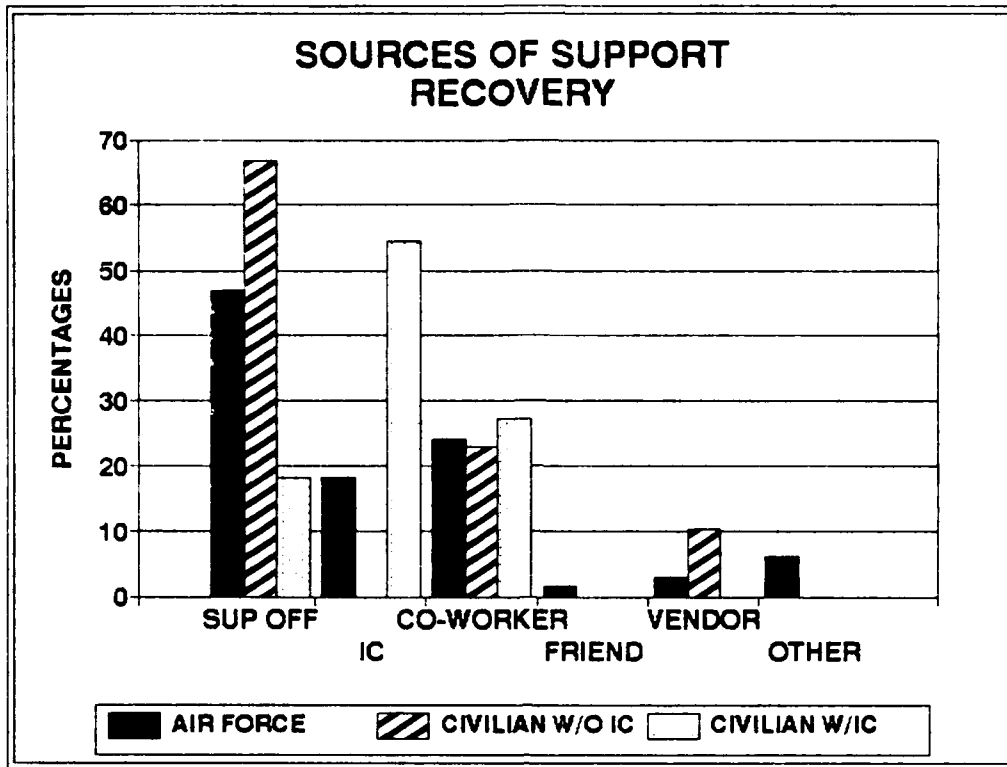


Figure 41. Percent of Recovery Support by Source

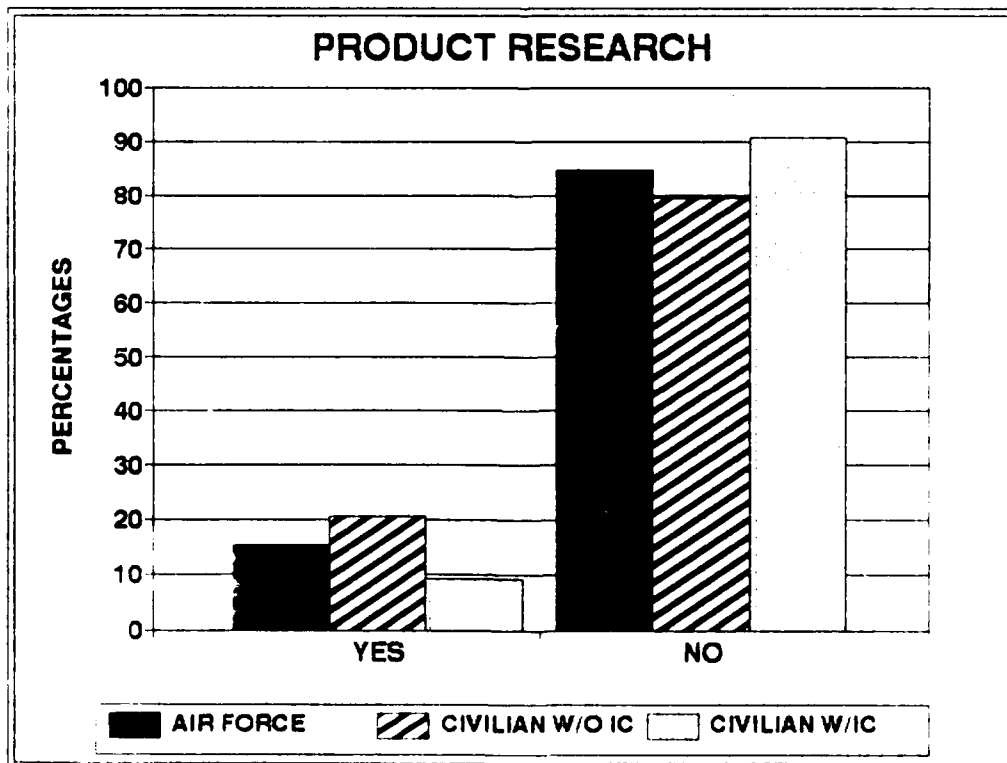


Figure 42. Percent Requiring Product Research Support

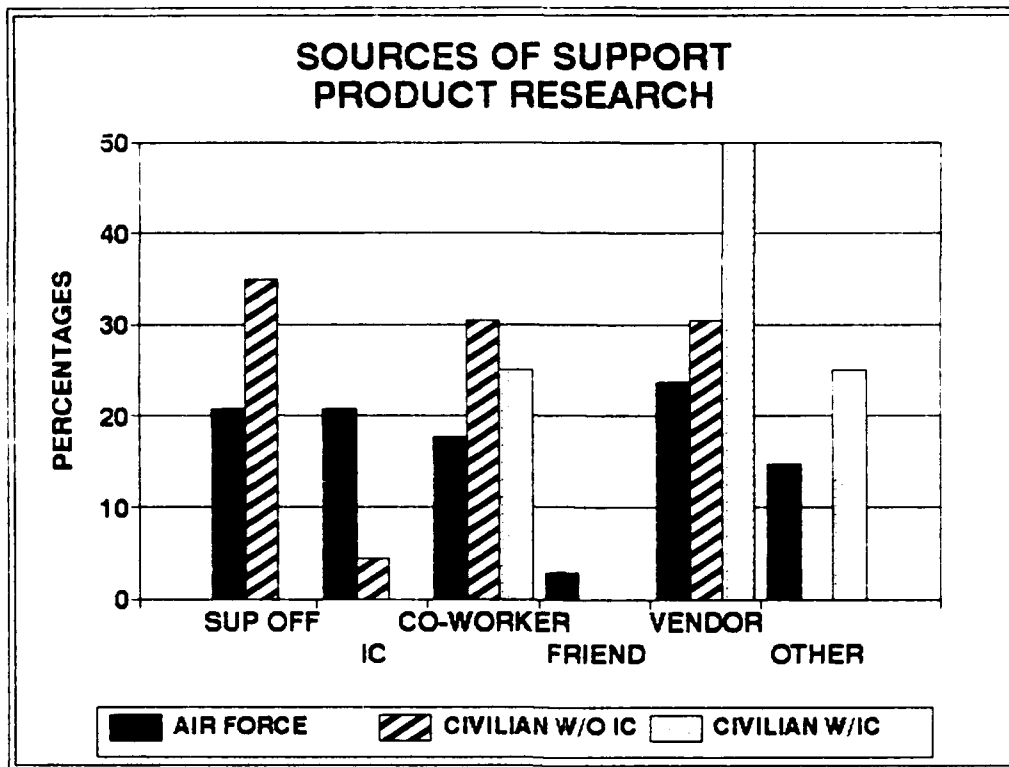


Figure 43. Percent of Product Research Support by Source

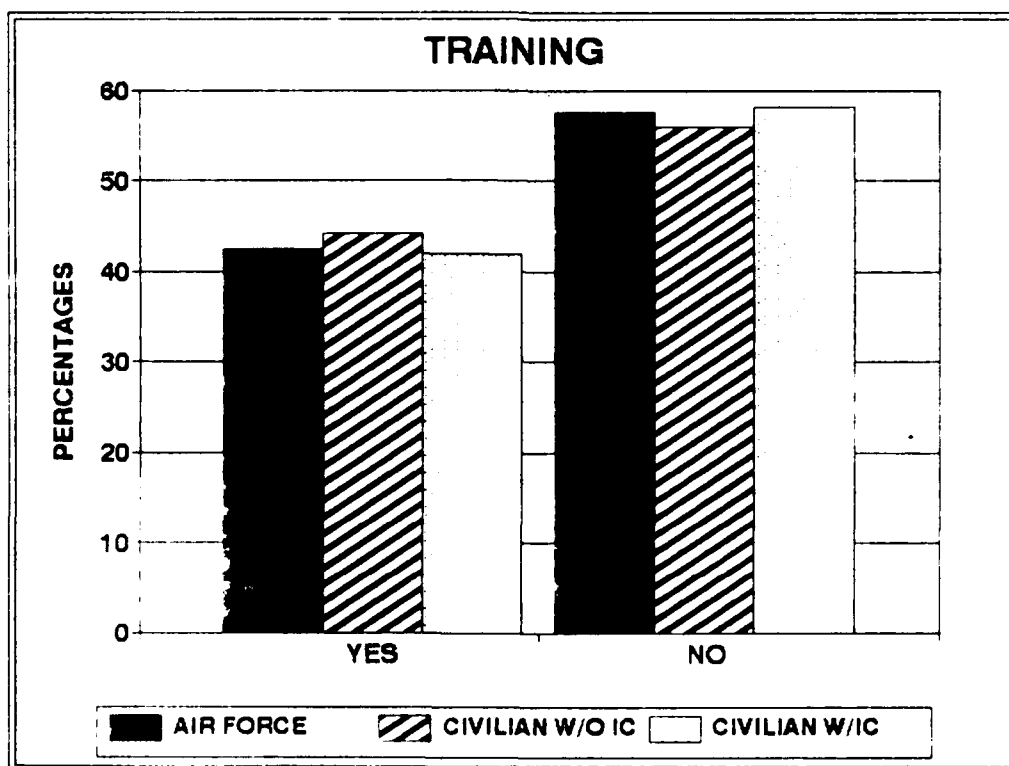


Figure 44. Percent Requiring Training Support

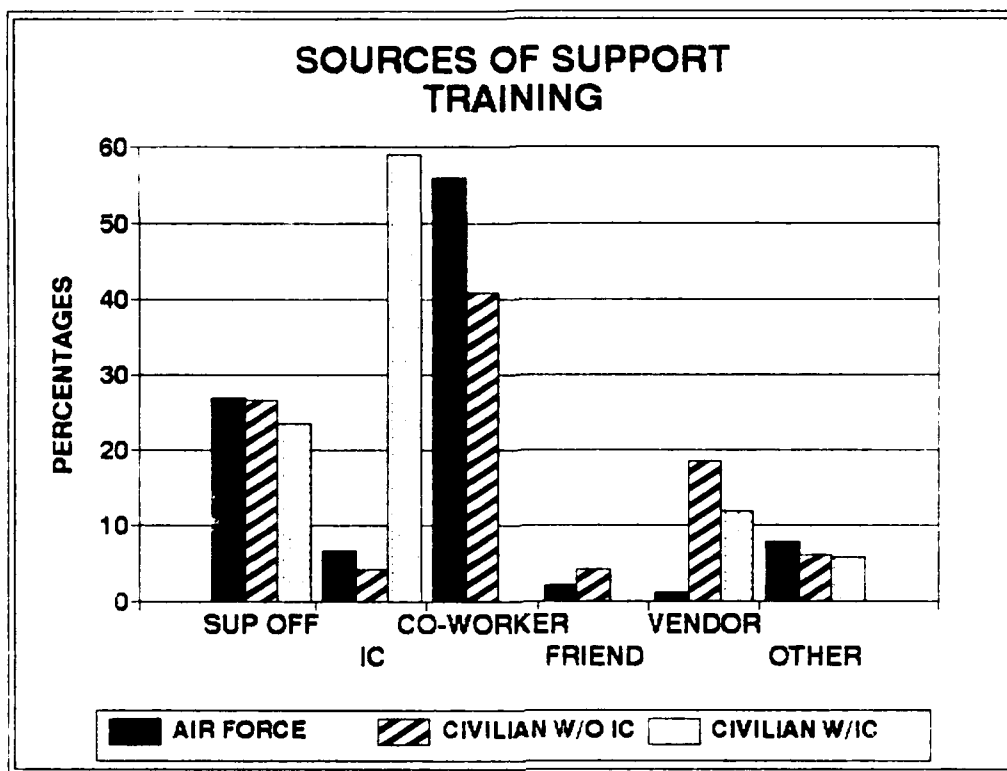


Figure 45. Percent of Training Support by Source

Appendix E: Chi Square Analysis Tables

Table 23

Chi Square Comparison of Gender Distribution

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	25.01	2.70554	1	Dependent
AIR FORCE CIVILIAN WITH IC	26.69	2.70554	1	Dependent
CIVILIAN WITHOUT IC CIVILIAN WITH IC	2.48	2.70554	1	Independent

Table 24

Chi Square Comparison of Confidence Levels Using Word Processors

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	10.65	6.25139	3	Dependent
AIR FORCE CIVILIAN WITH IC	3.87	6.25139	3	Independent

Table 25

## Chi Square Comparison of Confidence Levels in Using Spreadsheets

POPULATION COMPARISONS	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	5.4	6.25139	3	Independent
AIR FORCE CIVILIAN WITH IC	3.2	6.25139	3	Independent
CIVILIAN WITHOUT IC CIVILIAN WITH IC	1.16	6.25139	3	Independent

- 1 = I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
- 2 = I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
- 3 = I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
- 4 = I can perform all of the functions of the application; others seek my help in using the application.

Table 26

## Chi Square Comparison of Confidence Levels in Using Graphics

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	1.07	6.25139	3	Independence
CIVILIAN WITHOUT IC CIVILIAN WITH IC	.85	6.25139	3	Independence

- 1 = I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
- 2 = I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
- 3 = I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
- 4 = I can perform all of the functions of the application; others seek my help in using the application.

Table 27

Chi Square Comparison of Users of the Results of Computing

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	16.72	6.25139	3	Dependent
CIVILIAN WITHOUT IC CIVILIAN WITH IC	6.69	6.25139	3	Dependent

Table 28

Chi Square Comparison of End User Support Needs

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	10.085	19.8119	13	Independent
AIR FORCE CIVILIAN WITH IC	6.766	19.8119	13	Independent
CIVILIAN WITHOUT IC CIVILIAN WITH IC	9.268	19.8119	13	Independent

Table 29

Chi Square Comparison of End User Support Needs Not Met

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	9.93	19.8119	13	Independent
AIR FORCE CIVILIAN WITH IC	100.55	19.8119	13	Dependent

Table 30

Chi Square Comparison of the Sources  
of Support Selected by End Users

POPULATION COMPARISON	TEST STATISTIC	CHI SQUARE	df	DECISION
AIR FORCE CIVILIAN WITHOUT IC	13.77	6.25139	3	Dependent
AIR FORCE CIVILIAN WITH IC	100.23	6.25139	3	Dependent
CIVILIAN WITHOUT IC CIVILIAN WITH IC	153.90	6.25139	3	Dependent



Appendix F: Table of Means and Standard Deviations

Table 31

Population Comparison of Means for  
Quality and Quantity

Populations	Quality			Quantity		
	n	Mean	SD	n	Mean	SD
Air Force	241	5.95	1.06	229	5.63	1.07
Civ w/o IC	110	6.13	.88	105	5.84	.99
Civ w/ IC	44	6.25	1.04	42	6.17	.85

Statistical Test: Comparison of means and std dev

Table 32

Population Comparison of Means for  
Confidence and Productivity

Population	Confidence			Productivity		
	n	Mean	SD	n	Mean	SD
Air Force	257	4.07	.94	258	5.16	1.63
Civ w/o IC	111	4.17	.70	112	4.37	1.76
Civ w/ IC	42	4.38	.70	43	4.74	1.47

Statistical Test: Comparison of means and std dev

Table 33

Population Comparison of Mean Importance  
for each Type of Support

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	222	3.22	1.18	105	3.41	1.10	43	3.79	.83
Backup	231	3.42	1.26	98	3.43	1.16	43	3.61	1.26
Compatibility	233	3.47	1.24	101	3.70	1.06	42	3.86	.93
Development	226	3.31	1.29	98	3.65	1.10	42	3.74	1.13
Documentation	228	3.65	1.20	102	3.73	1.18	42	3.71	1.04
Hotline/Debug	224	3.25	1.41	97	3.42	1.35	40	3.83	1.04
List Resource	219	3.05	1.28	97	2.89	1.12	39	3.21	.95
Maintenance	231	4.00	1.22	103	4.07	1.14	42	4.19	.83
Data Transfer	225	3.39	1.31	96	3.09	1.26	40	3.38	1.03
Newsletter	225	3.06	1.30	98	2.60	1.13	42	3.24	1.12
Purchase Asst	219	2.97	1.40	95	2.83	1.33	40	3.55	1.11
Recovery	223	3.83	1.35	100	4.04	1.24	40	4.18	1.13
Research Prod	218	2.89	1.29	93	3.11	1.22	39	3.28	.94
Training	228	4.15	1.20	102	4.02	1.12	43	4.33	.81

Statistical Test: Comparison of means and standard deviations.

Table 34

Population Comparison of Mean Satisfaction  
for Each Type of Support

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	111	4.14	.78	63	4.00	.72	27	4.26	.59
Backup	98	4.31	.74	64	3.98	.90	19	4.16	.60
Compatibility	92	4.05	1.04	53	4.08	.81	18	4.00	.77
Development	95	4.12	1.00	62	3.98	.78	18	4.17	.62
Documentation	117	4.09	.93	59	3.88	1.02	20	4.05	.95
Hotline/Debug	62	4.11	1.06	45	4.02	1.08	14	4.07	.73
List Resource	58	4.09	.92	25	3.72	.98	3	3.33	2.08
Maintenance	130	4.14	1.01	66	4.14	.72	20	3.90	.97
Data Transfer	87	4.22	.80	38	3.76	.94	12	4.33	.78
Newsletter	69	4.13	.77	36	3.94	.79	15	4.13	.74
Purchase Asst	34	3.50	1.21	21	3.19	.98	13	4.23	.73
Recovery	70	4.24	.96	39	4.21	.89	9	4.00	1.00
Research Prod	34	4.09	.87	23	3.70	.77	3	3.67	1.16
Training	107	4.16	.84	51	3.88	.86	18	4.50	.62

Statistical Test: Comparison of means and standard deviation

Table 35

Comparison of Means for Satisfaction with  
Computer User Support Office

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	33	4.36	.60	22	3.86	.94	4	4.25	.96
Backup	34	4.32	.68	24	3.96	1.00	4	4.25	.50
Compatibility	36	4.31	.89	21	3.76	.94	2	4.00	.00
Development	23	4.22	.80	28	3.75	.93	2	4.00	.00
Documentation	28	4.36	.62	17	3.53	1.33	2	4.00	1.41
Hotline/Debug	26	4.38	.80	17	3.82	1.18	3	4.00	.00
List Resource	23	4.35	.78	9	3.56	1.01	0	.00	.00
Maintenance	53	4.34	.90	38	4.16	.79	4	4.50	.58
Data Transfer	37	4.46	.69	12	3.42	1.24	1	5.00	.00
Newsletter	24	4.21	.83	11	3.73	1.01	3	4.33	.58
Purchase Asst	16	3.69	1.08	12	2.92	1.03	0	.00	.00
Recovery	31	4.58	.72	26	4.00	.98	1	5.00	.00
Research Prod	6	4.33	1.03	8	3.13	.64	0	.00	.00
Training	26	4.31	.79	12	3.83	.94	4	4.50	.58

Statistical Test: Comparison of means and standard deviations.

Table 36

Comparison of Means for Satisfaction with Information Center

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	7	3.57	.98	6	4.17	.75	16	4.25	.58
Backup	5	4.40	.55	4	4.00	.82	8	4.25	.71
Compatibility	7	3.71	.95	6	4.67	.52	8	4.00	1.07
Development	9	4.22	.44	7	4.29	.76	10	4.20	.67
Documentation	15	4.07	.88	6	3.83	1.17	8	4.25	.89
Hotline/Debug	8	4.50	.76	6	4.50	1.22	5	4.00	1.00
List Resource	6	3.67	1.03	3	3.33	1.15	1	4.00	.00
Maintenance	9	4.00	.71	5	4.20	.45	5	3.40	1.14
Data Transfer	9	3.78	.97	6	4.00	.89	6	4.50	.55
Newsletter	10	3.90	.57	10	3.90	.57	4	4.00	.82
Purchase Asst	4	4.25	.96	0	.00	.00	8	4.25	.71
Recovery	12	3.75	1.22	0	.00	.00	5	3.80	1.00
Research Prod	6	4.33	.82	1	4.00	.00	0	.00	.00
Training	6	4.17	.75	2	3.50	.71	10	4.50	.53

Statistical Test: Comparison of means and standard deviations.

Table 37

## Comparison of Means for Satisfaction with Co-worker

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	48	4.08	.71	22	4.09	.53	4	4.00	.00
Backup	36	4.25	.91	22	4.18	.66	3	3.67	.58
Compatibility	23	4.35	.71	11	4.27	.47	1	4.00	.00
Development	37	4.43	.69	15	4.07	.46	1	3.00	.00
Documentation	38	4.29	.73	12	3.92	.90	2	4.00	.00
Hotline/Debug	5	3.60	.89	3	4.00	.00	0	.00	.00
List Resource	21	4.05	1.02	10	4.10	.88	2	3.00	2.83
Maintenance	14	4.21	.80	6	3.67	.52	1	4.00	.00
Data Transfer	25	4.08	.76	13	3.92	.49	4	3.75	.96
Newsletter	11	4.09	.70	6	4.33	.52	1	3.00	.00
Purchase Asst	4	2.75	.96	4	3.75	.50	1	3.00	.00
Recovery	16	3.81	1.05	9	4.56	.53	3	4.00	1.00
Research Prod	4	3.75	1.26	6	4.00	.63	0	.00	.00
Training	57	4.16	.77	20	4.15	.81	0	.00	.00

Statistical Test: Comparison of means and standard deviations.

Table 38

## Comparison of Means for Satisfaction with Friend Outside of Work

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	5	4.40	.89	1	4.00	.00	9	3.78	1.30
Backup	4	4.50	.58	1	4.00	.00	0	.00	.00
Compatibility	5	2.00	1.41	0	.00	.00	1	4.00	.00
Development	6	2.33	1.51	0	.00	.00	0	.00	.00
Documentation	7	2.86	1.77	0	.00	.00	0	.00	.00
Hotline/Debug	2	3.50	.71	0	.00	.00	0	.00	.00
List Resource	1	4.00	.00	0	.00	.00	0	.00	.00
Maintenance	1	5.00	.00	0	.00	.00	0	.00	.00
Data Transfer	3	4.33	.58	2	4.00	.00	0	.00	.00
Newsletter	2	4.00	1.41	0	.00	.00	0	.00	.00
Purchase Asst	1	4.00	.00	0	.00	.00	0	.00	.00
Recovery	1	4.00	.00	0	.00	.00	0	.00	.00
Research Prod	1	4.00	.00	0	.00	.00	0	.00	.00
Training	1	4.00	.00	2	3.00	1.41	0	.00	.00

Statistical Test: Comparison of means and standard deviations.

Table 39

## Comparison of Means for Satisfaction with Vender/Consultant

Support	Air Force			Civ w/o IC			Civ w/ IC		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Advise	9	3.78	1.30	7	4.00	.58	1	5.00	.00
Backup	7	4.43	.53	7	3.57	1.40	3	4.00	.00
Compatibility	10	3.80	1.03	8	4.00	.53	4	3.75	.50
Development	9	4.22	.83	8	4.38	.52	4	4.00	.00
Documentation	19	3.79	.98	15	4.40	.63	8	3.88	1.13
Hotline/Debug	9	4.11	1.54	16	4.00	1.10	6	4.17	.75
List Resource	3	4.00	1.00	0	.00	.00	0	.00	.00
Maintenance	42	3.93	1.20	13	4.08	.64	8	4.13	.99
Data Transfer	4	4.00	1.15	2	4.50	.71	0	.00	.00
Newsletter	13	4.38	.65	6	4.00	.89	6	4.50	.55
Purchase Asst	2	3.00	.00	4	3.75	.50	3	4.33	.58
Recovery	2	5.00	.00	4	4.75	.50	0	.00	.00
Research Prod	8	4.00	.76	7	4.00	.82	2	4.00	1.41
Training	1	3.00	.00	9	3.89	.78	2	4.00	1.41

Statistical Test: Comparison of means and standard deviations.

Appendix G: Percentage Distribution Tables

Table 40

Percentage Comparison of Age Distribution

POPULATION	% 25 OR LESS	% 26-32	% 33-39	% 40-46	% 47-53	% 54-61
AIR FORCE	18.4	39.5	33.2	8.6	0	0
CIVILIAN WITHOUT IC	3.4	16.1	17.8	26.3	21.2	15.3
CIVILIAN WITH IC	11.4	22.7	18.2	22.7	18.2	6.8

Table 41

Percentage Comparison of Educational Level Distribution

POPULATION	PERCENT HIGH SCHOOL DIPLOMA	PERCENT COURSES BEYOND HIGH SCH	PERCENT AS DEGREE TECH SCH CERT	PERCENT BACHELOR DEGREE	PERCENT MASTER DEGREE
AIR FORCE	13.2	47.7	19.0	16.3	3.9
CIVILIAN WITHOUT IC	4.4	29.8	12.3	36.0	17.5
CIVILIAN WITH IC	2.3	34.1	22.7	29.5	11.4

Table 42

## Percentage Comparison of Work Level Distribution

POPULATION	1	2	3	4	5	6
AIR FORCE	39.9	35.6	4.3	8.7	10.7	.8
CIVILIAN WITHOUT IC	28.9	5.3	5.3	13.2	40.4	7.0
CIVILIAN WITH IC	40.9	6.8	9.1	11.4	31.8	0

- 1 = I perform the basic work related directly to the production of my organization's products or services.
- 2 = I directly supervise those who perform the basic work of production.
- 3 = I manage the supervisors who supervise those who perform the basic work of production.
- 4 = I serve to bring about standardization in the organization through scientific methods.
- 5 = I am a specialist, providing support to the organization outside the operating work flow.
- 6 = I am at the top of the organization, charged with ensuring that the organization serves its mission in an effective way.

Table 43

## Percentage Comparison of Length of Computer Use Distribution

POPULATION	% LESS THAN 1 1/2 YEARS	% 1 1/2-3 YEARS	% 3-5 YEARS	% 5-10 YEARS	% 10 YEARS OR MORE
AIR FORCE	8.6	12.1	26.8	37.0	15.6
CIVILIAN WITHOUT IC	1.4	4.4	20.2	35.1	38.6
CIVILIAN WITH IC	0	6.8	31.8	43.2	18.2



Table 44

## Percentage Comparison of Formal Computer Education

POPULATION	% NONE	% HIGH SCHOOL	% COLLEGE COURSES	% ASSOC DEGREE	% BACHELOR DEGREE	% MASTER DEGREE	% OTHER
AIR FORCE	34.3	9.8	44.1	3.9	1.2	.4	6.3
CIVILIAN WITHOUT IC	24.6	.9	60.5	.9	1.8	.9	10.3
CIVILIAN WITH IC	11.6	0	74.4	0	4.7	0	9.3

Table 45

## Percentage Comparison of Confidence in Using Databases

POPULATION	% 1	% 2	% 3	% 4
AIR FORCE	27.88	45.67	11.54	14.90
CIVILIAN WITHOUT IC	29.33	42.67	14.67	13.33
CIVILIAN WITH IC	29.41	50.00	8.82	11.76

- 1 = I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
- 2 = I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
- 3 = I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
- 4 = I can perform all of the functions of the application; others seek my help in using the application.

Table 46

## Percentage Comparison of Confidence in Using Word Processors

POPULATION	% 1	% 2	% 3	% 4
AIR FORCE	14.53	32.05	29.91	23.50
CIVILIAN WITHOUT IC	8.08	50.51	22.22	19.19
CIVILIAN WITH IC	9.09	31.82	22.73	36.36

- 1 = I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
- 2 = I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
- 3 = I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
- 4 = I can perform all of the functions of the application; others seek my help in using the application.

Table 47

## Percentage Comparison of Confidence in Using Spreadsheets

POPULATION	% 1	% 2	% 3	% 4
AIR FORCE	33.56	31.51	19.86	15.07
CIVILIAN WITHOUT IC	20.00	32.50	27.50	20.00
CIVILIAN WITH IC	23.68	28.95	21.05	26.32

Table 48

## Percentage Comparison of Confidence in Using Graphics

POPULATION	% 1	% 2	% 3	% 4
AIR FORCE	33.53	36.47	14.12	15.88
CIVILIAN WITHOUT IC	27.27	42.42	15.15	15.15
CIVILIAN WITH IC	33.33	33.33	15.15	18.18

Table 49

## Percentage Comparison of Confidence in Using Telecommunications

POPULATION	% 1	% 2	% 3	% 4
AIR FORCE	33.58	32.84	17.16	16.41
CIVILIAN WITHOUT IC	25.00	50.00	16.67	8.33
CIVILIAN WITH IC	7.14	64.29	14.29	14.29

- 1 = I can perform only basic functions following prompts or menus; I usually need help recovering from mistakes.
- 2 = I can perform all of the basic functions and follow instructions in the manual for more advanced functions; I sometimes require help in performing the more advanced functions.
- 3 = I can perform all of the basic and advanced functions; I rarely, if ever, require assistance.
- 4 = I can perform all of the functions of the application; others seek my help in using the application.

Table 50

## Percentage Distribution of Users of the Results of Computing

POPULATION	% No one	% I don't know	% User	% User's boss	% User's Unit	% Other Units
AIR FORCE	3.66	.81	15.45	6.91	44.30	28.86
CIVILIAN WITHOUT IC	1.90	0	26.67	14.29	24.76	32.38
CIVILIAN WITH IC	0	0	19.51	29.27	12.20	39.02

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### Vita

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